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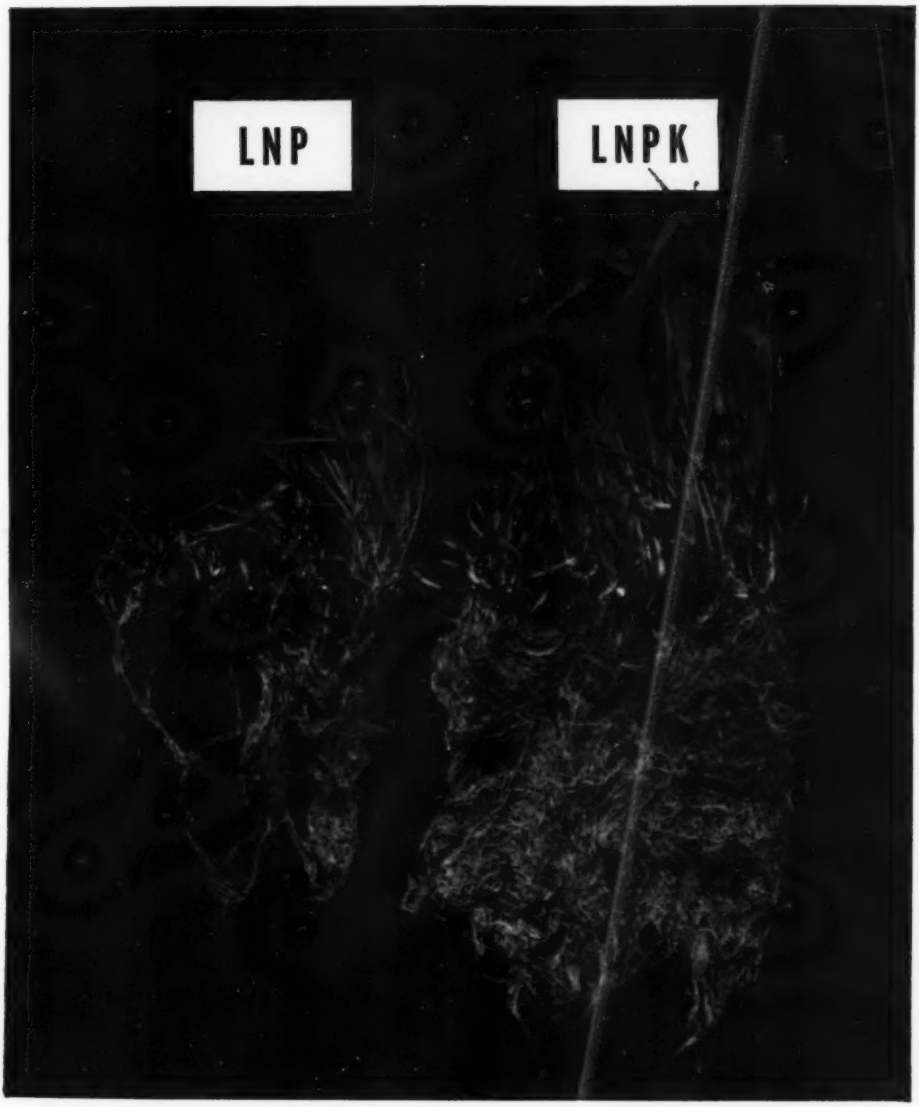

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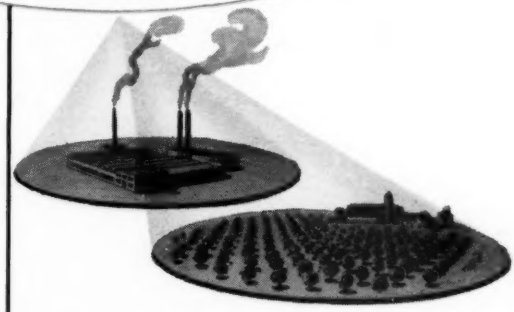

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVII NO. 2

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Sugaring Time Again!

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VOL. XXXVII WASHINGTON, D. C., FEBRUARY 1953 No. 2

The background for . . .

Information's Harvest

Jeff McDermid

IN our widespread rural observance of fifty years of service in farm demonstration work, we are in reality reaping the harvest of a practical, down-to-earth reform and perfection of all the methods of information. There has been more advancement in agriculture during the era between the turn of the century and the present than this nation's farmers saw or their ancestors realized in the entire span of time since country dwellers emerged from serfdom in the Middle Ages.

When fellows of my generation went to public schools and colleges between 1900 and 1910 nobody ever thought of holding classes in farm improvement. The roads were poor; the soils beginning to falter in their fertility; the boys were looking vainly toward the cities for security and wealth they could not find on farms; and their sisters faced rather narrow and unpromising outlooks and opportunities to achieve that goal of gracious homemaking that every young woman treasures as her heart's desire.

I think at that period at least three things retarded us from the progress we enjoy today. For one thing, we lived when there was yet a little "new land" to be had for the homesteading, and those who grew poor and stagnant and restive on local farmsteads merely sought the golden west as the solution of their problem. For another thing, education had not yet cleared the hurdle of bookish dullness and slavish precedent. Our schools did not see the need for manual and physical lessons to make those mathematical problems come to life. Few, if any, classes in home economics (domestic science) or shop practice were found to inculcate that zeal for achievement with the

hands which enriches and balances the fruits of the mind. And finally, such science as we had had been so absorbed in the marvelous revolutionary discoveries of the Edison age on a broad front that the benefits it might do for soils, crops, and domestic animals remained to be explored.

We cannot look back there to 1903 and say that we were ignorant and complacent and unaware of our duties and responsibilities. All that ailed us was lack of imagination to apply to farming and rural life some of the science and the teaching that had been so successful in making America the Mecca for immigrants and the scene of the world's greatest industrial inventions. Thus the stage was set and the curtain was ready to rise on the first fifty years of the twin actors—"Find-How" and "Tell-How."

WHILE most of the current observances center on the introduction of farm demonstration work to the Gulf States and Texas by Dr. Seaman A. Knapp of the U. S. Department of Agriculture's Bureau of Plant Industry, it is important to remember that similar pioneer reforms in research and information were going on in several key states where agriculture was awakening and shaking off its lethargy.

Because Dr. Knapp was so prominent and had so many warm admirers and followers, the channel of progress then emerging as a tiny rivulet under his watchful eye becomes the main stream on which we trace the course of rural education that is now a torrential flood—which sometimes even overflows its banks. Like the skeptic who sneered at the steam engine and said "You'll never start her," we also bow in resignation as he did later, exclaiming "You'll never stop her!"

Seaman A. Knapp was born in the Adirondack Mountains of New York in December 1833. His folks had moved in and settled there before the Revolution. His grandfather was a rural doctor of the old school. After the usual district school training, young Knapp entered an academy at Poultney, Vermont. Here he met the woman he married in 1856. It was in that year he graduated with honors from Union College at Schenectady.

Upon their marriage the young couple started teaching at Fort Edward Institute. The two of them received $300 a year with board for their knowledge of Latin, Greek, and art. With savings from his wages and a little share in the Institute, the young Phi Beta Kappa professor bought an old academy at Troy and made it into the Ripley Female College. He was well on the road to prosperity here when an accident on the baseball field put him at a great physical disadvantage until the early seventies, when he recovered and was again able to walk freely.

We next see the young folks settled in a Methodist parsonage in Vinton, Iowa, thence to be supervisor of the Iowa College for the Blind which he made solvent and where he added a musical conservatory to boot. Thereupon he blazed himself a new trail, one that culminated in his agricultural leadership. He bought and operated a diversified farm near Vinton, Iowa. He meanwhile found time to do a little writing and editing for the Western Stock Journal and Farmer. Thanks to his acquaintance with the big guns in agriculture of those days—like Tama Jim Wilson and Uncle Henry Wallace—Dr. Knapp occupied the first chair of agriculture at Iowa State College and graduated its first class in 1883, at the age of 50 years. The next year he became president of the institution and thereupon received a promising offer from the South. They wanted a man with experience in farm leadership to head up the extension work for the Rice Growers Association. Dr. Knapp introduced rice culture in Texas and Arkansas. This soon led to his appointment as a plant explorer and foreign agricultural scout for the Bureau of Plant Industry.

The boll-weevil threat faced the

South. Secretary Wilson handed the tough task of educating plantation owners on rotations and practices that might help to check the weevil to Dr. Knapp and associates. He got some early encouragement and financial aid from Rockefeller's General Education Board and the Texas Midland Railroad. In January 1903 Dr. Knapp and several local farmers and businessmen met at Terrell, Texas, and drew up a

cooperative agreement to establish a demonstration farm. The local people were entrusted with all of the financial guarantees and were expected to find the right farm. If any profits might accrue, the farm operator was to get the benefit in lieu of rent and labor. Not a penny of Federal government money was spent. The farm chosen was owned by Walter C. Porter. The idea was to devote 70 acres to the demonstrations.

This acreage was about equally divided between cotton and corn. Half of it was farmed in the customary ways and half by the newer methods—better varieties, balanced fertilizers, and special planting and cultivation. At the close of the year's records it was found that Mr. Porter had netted about $700 greater profit from the area managed in modern style than on the acreage treated in ordinary ways. Thus there was no drain on the purse which the committee had collected to repay Mr. Porter in case of financial loss. Bear in mind that this committee was composed of neighbors, and you know what that means when a farmer is out to perform miracles or introduce new methods.

This and succeeding ventures with demonstration plots and farms soon gave Dr. Knapp the informal title of "Schoolmaster of American Agriculture." He branched out beyond the land demonstration feature. He helped organize and promote boys' corn clubs and girls' canning clubs. Some of the present-day leaders in state colleges of agriculture as well as the U. S. Department of Agriculture were members of those first clubs. Thus in a broad way Dr. Knapp is the forerunner and John the Baptist for the 4-H clubs as we know them today. He died at Washington, D. C., in April 1911 at the age of 78 years. Those who cross the eastern ramp that connects the two agricultural buildings in Washington, D. C., are reminded of the early era of "find-how" and "tell-how" by the oil portrait of Dr. Knapp on the corridor wall.

PERHAPS some day we shall start a portrait hall of fame for other subsequent leaders and founders of agricultural information and extension education. No better place than alongside of the Knapp portrait could be found to display the faces of those men and women who have since contributed nobly to the work Dr. Knapp envisioned. A committee of authorities could be named whose duty it would be to study all the recommendations received for such nominations and pick the ones to be thus distinguished and immortalized.

Along the other, or western arch, causeway that connects the agricultural buildings, where the portrait of Secretary Wilson hangs, it would be equally worth while to install a similar gallery of the portraits of eminent research scientists in agriculture and animal husbandry whose outstanding work made possible the "find-how" that precedes the "tell-how."

For there is always grave danger of overdoing one instance, one program,

(*Turn to page* 51)

Grasses and Weeds— The Potash Robbers

By R. E. Blaser and N. C. Brady

Virginia Agricultural Experiment Station, Blacksburg, Virginia, and Cornell University, Ithaca, New York, respectively.

A MAJOR headache for most livestock farmers is the problem of improving the summer production of meadows. One of the ways by which this is often done is to apply fertilizer in the spring after harvesting for silage or hay. Farmers have even attempted to bring old and degenerated meadows back into production by such fertilization and some have succeeded. They have not always been rewarded by such good luck, however.

The importance of balanced fertilization in improving summer forage production was studied by the authors in experiments at Cornell University. A meadow in the fourth year of production was chosen for this work. Mixtures of nitrogen, phosphorus, and potash were added to the meadow after a silage cut had been made in the spring of 1947. The sod was not thick, being made up of timothy, bluegrass, quackgrass, broadleaf weeds, and a poor stand of ladino clover. Alfalfa and red clover, seeded four years earlier, had died out.

Results from Experiment I

Contrary to our expectations, the clover and desirable grasses did not respond to phosphate fertilization. This soil was low in potassium and nitrogen, and responses to applications of muriate of potash and ammonium nitrate were obtained. Fifty pounds of potash (K_2O) increased the ladino clover yield from 534 pounds to 1,108 per acre during the summer and fall months of 1947. The ladino clover treated with nitrogen and potash was lower in yield than the clover on plots that were treated only with potash. The yields of the mixed herbage—grasses and clover together—were 3,244 pounds when treated with both nitrogen and potash, Table I.

Why was there less ladino clover in the sod that was treated with nitrogen and potash than in sod treated with potash alone? Nitrogen fertilizer pushed off the grass growth quickly, and ordinarily grasses would shade out

TABLE I.—THE YIELDS AND POTASSIUM CONTENT OF GRASSES AND LADINO CLOVER GROWN IN A SOD WERE INFLUENCED BY NITROGEN AND POTASH FERTILIZATION.*

Potash and nitrogen treatments	Ladino clover	Grasses	Clover and grasses
Herbage yields—pounds per acre			
0	534	2,038	2,572
50 lbs. of K_2O	1,108	2,136	3,244
50 lbs. each N and K_2O	750	2,426	3,176
Potassium (K_2O) content of herbage			
0	1.15	1.73	.....
50 lbs. K_2O	1.70	2.42	.....
50 lbs. each N and K_2O	1.37	2.02	.....

*The fertilizers were applied in June 1947 after the first crop was cut for silage. Phosphorus was applied uniformly.

the lower-growing ladino clover. To keep the grasses from shading the clover, however, the grass-clover mixture was mowed when 6 to 8 inches tall. Even with this precaution the clover stand and growth were poorer with the nitrogen-potash treatments than for the potash plots without nitrogen. As the season advanced we noticed potash deficiency on ladino clover growing on plots that were treated with the nitrogen-potash fertilizer mixture. We found that the clover taken from the plots treated with nitrogen and potash was lower in potassium than the clover taken from plots treated with only potash, Table I and Fig. 1. Regardless of the treatment the grasses in the mixture were higher in potassium content than was the ladino clover. By calculation it was found that the grass-clover mixture treated with both nitrogen and potash removed much more potassium than the grass-clover mixture treated with only potassium. There was more grass in the sod treated with nitrogen and potash, thus more potassium was removed through the harvested herbage.

Second Year's Results, Experiment I

Now let us follow the story for the same experiment the next year, 1948.

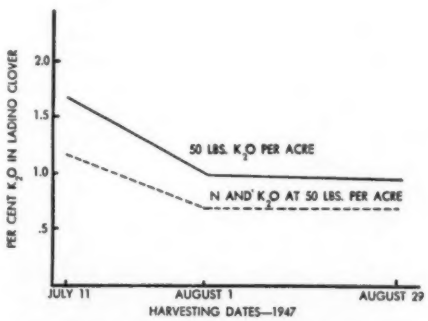

Fig. 1. Potassium content of ladino clover grown with a grass sod. Ladino clover was lower in potassium content for the K_2O-N treatment than for K_2O alone. Nitrogen fertilizer stimulated the growth of grass. The high grass yield coupled with this high potash absorption caused the clover in the sod fertilized with nitrogen to be low in potash.

Remember that fertilizers were last applied after cutting for silage in June 1947. The plots were again cut for silage in early June of 1948. The previous year's potash fertilization (50 pounds of K_2O per acre) gave a dry matter yield of 2,040 as compared with 1,546 pounds for plots treated with nitrogen and potash, Fig. 2. Where 100 pounds of potash (K_2O) were applied, the dry matter yield was 2,500 pounds per acre. The clover content was very low in all treatments, but lower when treated with nitrogen and potash than when treated with potash alone.

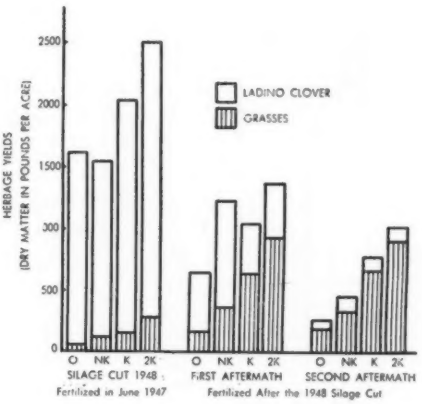

Fig. 2. The yields of dry matter per acre (grasses and ladino clover given separately) as influenced by nitrogen and potash fertilization. The plots were treated uniformly with phosphorus. (N = 50 pounds of nitrogen and K = 50 pounds of potash (K_2O) per acre.)

After the silage was removed, the fertilizer mixtures used in 1947 were repeated on the same plots in 1948. The first yield after fertilization gave 1,229 pounds of mixed herbage from plots treated with nitrogen and potash as compared with 1,037 pounds for potash alone, Fig. 2. The ladino clover yield was much lower in herbage from the nitrogen-potash than potash-treated plots. At this harvest date the nitrogen topdressings gave the grasses a tremendous boost. This improved the summer feed supply even though the clover yield was reduced.

In the second aftermath growth the grass yields on the plots treated with potash alone or with a nitrogen-potash mixture were similar. However, there was about twice as much clover in the sod in plots treated with potash as compared with plots treated with nitrogen and potash.

By referring to Fig. 3, it can be seen that the grasses were much higher in potassium content than the legumes and the weeds were higher in potash than the grasses. Ladino clover was critically low in potash, .72% as compared with 1.70% for grasses in the silage harvest.

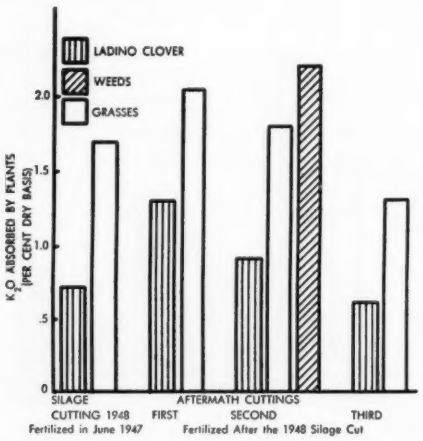

Fig. 3. The percentage potash (K_2O) content of ladino clover, grasses, and weeds when grown together on a sod. The results are averages for all potash and nitrogen treatments.

It is known that grasses such as timothy, quack, and bluegrass grow at lower temperatures than ladino clover. For this reason the grasses start growing earlier in the spring than ladino clover. Since this soil was very low in available potash, the early growing grasses apparently absorbed most of the available potash, thus explaining the small amount of potash absorbed by the ladino clover in the spring.

Potash or the nitrogen-potash mixture applied after the silage cut in the spring increased the amount of summer feed. Nitrogen increased the grass production and potash the clover production. Potash fertilizer also increased the amount of potassium in both the clover and grass during the summer. The grasses were much higher in potassium content than the clover for each harvest shown in Fig. 3. Weeds, analyzed in one harvest, were higher in potash than the grasses.

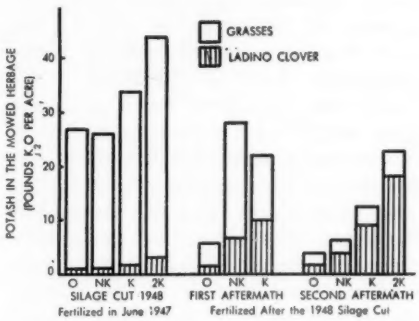

Fig. 4. Potash (K_2O) in the harvested herbage of a grass-ladino clover sod treated with nitrogen and potash fertilizers. (See Figs. 2 and 3 for dry matter yields and potash (K_2O) content of plants.) (N = 50 pounds nitrogen per acre and K = 50 pounds of potash (K_2O) per acre.)

The amount of potash removed separately by grasses and ladino clover for each harvest in 1948 is given in Fig. 4. For the nitrogen-potash treatments, the herbage cut for silage had 26 pounds of potash (K_2O) on an acre basis. Of this 26 pounds the ladino clover growing with the grass absorbed only 0.9 pound per acre. This high absorption by the grass is attributed to the high K_2O content in the grass and the large amount of grass in the clover-grass mixture, see Figs. 2 and 3. Looking at Fig. 4 again, the herbage treated with 50 pounds and 100 pounds of K_2O during the previous year removed 34 and 44 pounds of K_2O per acre, respectively. Here again the grasses had absorbed most of the potash.

The nitrogen and potash fertilizer mixtures applied after the silage harvest in 1948 stimulated the grass and clover growth. Fig. 2 shows that with nitrogen fertilization the herbage was two-thirds grass. In the absence of nitrogen (potash alone) the mixture was made up of about two-thirds clover.

Because of the grassy sod in the nitrogen-potash treatment and the high potash absorption by grasses, the mowed herbage removed 28 pounds of K_2O in the first aftermath harvest. Of this 28 pounds the grass removed 21.3 pounds. This left 22 pounds of the potash applied in the fertilizer for the second aftermath harvest. However, the clover in the grass-clover mixture treated with nitrogen and potash decreased even though the grass yield in the mixture of the second aftermath was low (see Fig. 2). The grass stubble and roots as stimulated by nitrogen apparently absorbed most of the available fertilizer potash. At any rate, in the second aftermath the clover in the grass-clover mixture as well as the total yield of herbage for the potash treatments was higher than for the combined nitrogen-potash treatment.

Since grasses absorb more potash than ladino clover and because nitrogen fertilizers stimulate grasses, a critically low potash supply for ladino clover was created in this soil low in potassium. It may be stated that the grasses and clovers compete for potassium and in this respect grasses are aggressive toward clover. Grasses are "piggish" since they absorb much more potassium than they need for normal growth. For normal growth the grasses have a lower potash requirement than ladino clover, yet grasses absorb more potash than ladino clover when the two are grown in a mixture.

Experiment II

Since nitrogen fertilizer with light rates of potash reduced the stand and growth of ladino clover, a study was made on the possibility of maintaining ladino clover in a sod by applying plenty of potash. To do this a second experiment was put out on an adjacent area of the same sod. Three rates of nitrogen fertilizer (0, 50, and 100 pounds of N per acre) were applied with each of three rates of potash (0, 75, and 150 pounds per acre). Uniform phosphate applications were made to all plots.

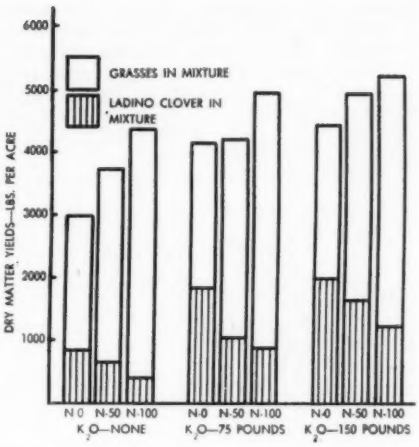

Fig. 5. An established meadow mixture (ladino clover, timothy, bluegrass, and quackgrass) was treated uniformly with phosphorus and with different nitrogen and potash fertilizers. The yields and amounts of grasses and clover in the mixture were changed by fertilization. (N = nitrogen and K_2O = potash given in pounds per acre.)

For this experiment, the yields for 1948 are given in Fig. 5. As more nitrogen fertilizer was applied, the yield of mixed herbage was increased. Nitrogen fertilizer gave the largest increases in growth in plots without potash where the clover in the sod was poorest. However, the highest yield per acre was made possible with the combination of high nitrogen and potash treatments. Considering each of the three nitrogen fertilizer treatments separately, the total yield and clover yield were increased as more potash was added. With heavy nitrogen fertilizer there was more clover in the sod as more potash was added. For example, with 100 pounds of nitrogen fertilizer the yields of ladino clover were: with no potash—410 pounds; with 75 pounds of potash—864 pounds; and with 150 pounds of potash—1,227 pounds of clover. The adding of potash to plots liberally fertilized with nitrogen made grasses less aggressive toward clover because the clover was less starved for potash.

The reason for this effect of nitrogen and potash fertilization on the clover growth is again related to potassium

TABLE II.—LADINO CLOVER ABSORBED LESS POTASH THAN GRASSES AND WEEDS WHEN THE THREE SPECIES WERE GROWN TOGETHER. POTASH AND NITROGEN FERTILIZATION INFLUENCED K ABSORPTION.

Fertilizer lbs. per acre	Potash (K_2O) content		
	Ladino clover	Grasses	Weeds
K_2O—none*	.96	1.96	2.16
K_2O—75 lbs.*	1.80	2.78	3.10
K_2O—150 lbs.*	2.47	3.18	3.99
N—none**	1.88	2.82	3.29
N—50 lbs.**	1.70	2.60	3.02
N—100 lbs.**	1.64	2.51	2.93

* Averages for all three nitrogen rates.
** Averages for all three potash rates.

absorption (see Table II). As more potash was added, potassium absorption by the plants was increased. For any one rate of potash fertilization, the grasses were higher in potash than the ladino clover and weeds were higher than the grasses. The treatment and potash absorbed were: without applying potash—ladino clover .96% K_2O, grasses 1.96% K_2O, and weeds 2.16% K_2O; with 150 pounds of K_2O per acre—ladino clover 2.47% K_2O, grasses 3.18% K_2O, and weeds 3.99% K_2O. As more nitrogen fertilizer was added, the potash content of the plants became less. The potash content of ladino clover was: with no nitrogen 1.88%, 50 pounds nitrogen 1.70%, and 100 pounds nitrogen 1.64% K_2O. This again shows that the stimulated yields of grasses and weeds due to nitrogen fertilization along with their high absorption of potash left a lower supply of potash in the soil for the ladino clover.

The clover growth was not as good with high as with low applications of nitrogen fertilization, even though heavy applications of potash were used. It is quite possible that the highest rates of potash were not high enough to maintain clover when nitrogen was used. But the aggressive nature of grasses toward clover should not be attributed to the competition of potassium alone. Factors other than competition for potassium among grasses and legumes are important.

Pasture Management

Stands of low-growing clovers like ladino and white clover are often lost in sods because the tall and erect grass growth shades out the clover. Grazing to remove grasses improves the light at the level where clover is growing. This method of grazing usually improves the amount of clover in the sod. Spring management is especially important in maintaining clover. The northern grasses grow earlier in the spring than ladino clover, thus early spring grazing to set back the grasses helps maintain clover.

Nitrogen topdressing improves the early spring and summer growth of sods. When nitrogen is used in the spring it is especially important to graze early to reduce the aggressiveness of grasses. With summer nitrogen applications, which will become more popular because nitrogen improves the summer feed supply, the grasses are not as competitive as in the spring.

Ladino clover is more apt to be injured by low and high temperatures and drought than grasses in the same sod. The shoot and root buds of ladino clover located on the surface runners are easily damaged by dry and hot weather under closely grazed conditions. In the absence of snow cover, these buds may be killed by low temperatures. Diseases and insects generally injure the stand and growth of legumes more than the stand of grasses.

Better and more information is needed to understand why meadows and pastures shift to a grassy or a leguminous sod. In this story we have shown that grasses and weeds are aggressive toward ladino clover, because these plants develop a potash shortage in a soil low in potash. The clover is

(*Turn to page* 47)

Fig. 1. Vermont with its upland farms and valley farms, its good land and its poor land, is a fertile field for the practical application of sound agricultural conservation practices. Here is a panorama of typical Vermont land resources in Bennington County, Vt.

Sixteen Years of Soilbuilding on Vermont Farms

By Thomas H. Blow

Production and Marketing Administration, Burlington, Vermont

SIXTEEN years of "on the farm" application of Agricultural Conservation practices have brought results to Vermont farmers. During that time an average of 11,639 Vermont farmers have enrolled annually in the program and these farmers represent 89 per cent of the commercial farms and over three-fourths of the cropland in the State. (1950 Census data used.)

Since the Agricultural Conservation Program started in 1936 and through the year 1951, over one million tons of ground limestone have been used. In addition over 500,000 tons of 20 per cent superphosphate equivalent and some 35,000 tons of 50 per cent muriate of potash equivalent have reached Vermont soils through the ACP practices.

Even with these amounts being applied, the job, according to the needs of the soil, has only partially been accomplished. This statement is based on Vermont Experiment Station findings which indicate annual needs of 300,000 to 400,000 tons of ground limestone, 200,000 tons of superphosphate, and 90,000 tons of 50 per cent muriate of potash equivalent.

Soil test results reported by the State's soil testing laboratory show definite indications that progress is being

Fig. 2. Reclaimed cropland on the farm of Charles Swan, Jericho, Vt. The field on right is just three years removed from that on left. The ACP pasture improvement practice made this possible.

made with our liming program. This fact is borne out through the increase in the pH on tests which have been taken within the past year. There is also an increasing number of farmers requesting soil tests, and liming materials are being used more in accordance with what the soil tests show. Therefore, much has been accomplished when farmers are deciding in greater numbers that soil tests can be a good guide to follow in both liming and fertilizing operations.

Vermont farmers have not confined themselves to just a lime and fertilizer program. These were, however, the

Fig. 3. The work on this diversion ditch under construction on the Carlos Dunn farm, East Ryegate, Vt., is being done by the County Soil Conservation District.

first things that needed to be done. As the soils have been rebuilt and put in order gradually (but still with much to be done), farmers have become interested in those practices of a more permanent nature. Farmers have also become encouraged because they could get help with their woodlands, sugar orchards, and tree planting. They have been able to reclaim many acres of good nearby pasture and cropland to provide for increasing cow numbers, and they have been able to make present acres more suitable for cropping through ditching and farm drainage. In addition, a more adequate farm land water supply has been made possible by the conservation of water through building farm ponds.

What Has Been Done

A glance at some of the accomplishments in the more permanent type practice field shows that in the 16-year period of ACP, 8,100 acres of land have been planted to forest trees. This means that at the rate of 1,000 trees per acre, more than 8 million forest trees have been started on their way to produce timber for future farm owners. In addition to tree planting, 7,900 acres of present farm woodlands have been improved under the guidance of county foresters, and since 1936 over 51,000 rods of fence have been built to protect Vermont woodlands and sugar orchards from excessive cattle grazing. These forestry practices serve as an answer to those that may feel little, if anything, is being done to preserve our forests and woodlands.

With an increase in the State's cow numbers and the need for better pastures, every one of the 14 counties have taken part in the clearing land practice which has been available since 1941. Since that time, well over 18,000 acres of land have been improved so as to make them fit better into the farm roughage picture. Much of this improved land has made possible a thriving Green Pastures program that has so well served Vermont farmers for the past five years. These new acres and those acres which have been rebuilt through the use of lime, superphosphate, potash, and mixed fertilizers have made it possible to bolster production of

Fig. 4. Green ladino pastures were made possible through ACP lime, superphosphate, and potash practices on the farm of Eldred French, Hinesburg, Vt. During 1947-52, Mr. French has used 136 tons of ground limestone, 100 tons of superphosphate, and 18 tons of 0-14-14 and 0-20-20 mixed fertilizer. He had to purchase $1,600 worth of hay to help carry 38 head of cattle during the 1949-50 season. Today he is growing ample roughage for 60 head and has some to spare.

Fig. 5. This well-managed woodlot is on the farm of Edgar Smith, Starksboro, Vt. For several years he has taken advantage of the ACP woodland improvement practice.

good legumes and assist in increased dairy products production.

Vermont has many acres that need farm drainage. There are many acres where open ditching will do the job; other acres where tile drainage is necessary; and others where diversion ditches will better serve. With these practices, over 650,000 cubic yards of open drainage ditches were dug since 1947; some 50,000 feet of tile drainage have been laid; and since 1949, over 4,600 rods of diversion ditches have been

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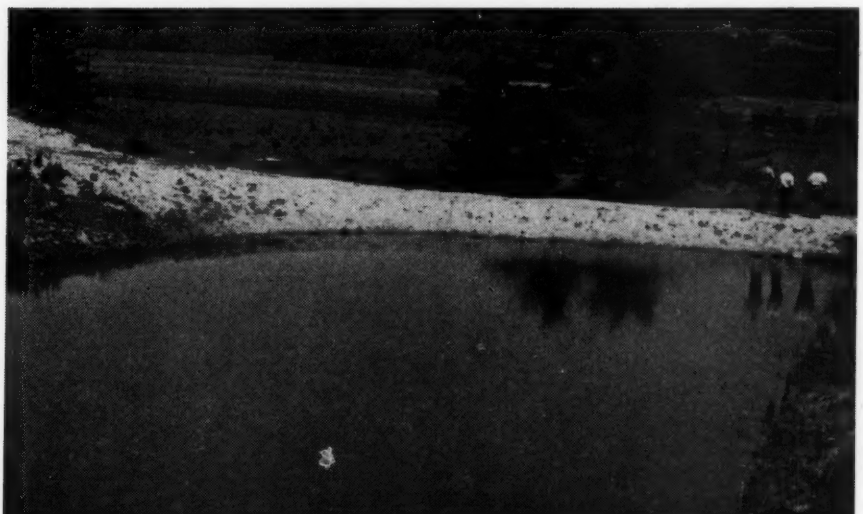

Fig. 6. A well-built and well-kept farm pond on the Walter Doenges farm, Williston, Vt., conserves the water supply and distributes livestock grazing.

Palatability of Plants as Influenced by Soil Treatment and Variety Differences

By M. J. Funchess

Dean Emeritus, School of Agriculture and Agricultural Experiment Station, Alabama Polytechnic Institute, Auburn, Alabama

NOT very many years ago a large part of the agronomic research in the South dealt with field-plot experiments involving cotton, tobacco, corn, and peanuts. These were the chief cash and maintenance crops of the area, and it was logical that the agronomists put most of their efforts into experiments with them. However, it became apparent that the South could not become a prosperous farm area unless its farmers had a broader base for income than cotton, tobacco, and peanuts could supply.

It was apparent, also, that if the available cropland was to be brought into use in commercial agriculture—the production of farm commodities for sale—a livestock program adapted to the area would have to be developed. In the effort to meet this need, the experiment stations of the South began to expand their programs of research into the field of production of feeds and forages that could be used to support some kind of livestock.

The Alabama Agricultural Experiment Station was among the first to put great emphasis on experiments looking toward this end. The narrative report that follows sets out some observations that were made on experiments conducted on some of the units of the experiment station system, and one farmer's observation of a similar nature. These should be of value to research workers and teachers of agriculture in several subject-matter fields, and they should stimulate new experiments, the object of which is to explain the results observed.

About 1941, the Wiregrass Substation near Headland, Alabama, conducted a relatively simple fertilizer test with peanuts on a soil that is probably Greenville Sand. There were some 8 or 10 fertilizer treatments applied to plots laid out in the conventional manner. Basic slag was applied to one half of each plot, regardless of treatment. When the peanuts were mature, the crop was "hogged off." And this is what happened: Regardless of the individual fertilizer treatments on the plots, the hogs ate *first* all of the peanuts from that half of the area that received an application of basic slag. On the other hand, they grazed about equally well both the variously fertilized and the unfertilized plots in the slag-treated area. There is no information available to show which constituent of the basic slag was the cause of the production of peanuts that were more attractive to the hogs than were those peanuts from the area that did not receive slag. Did these peanuts taste better only? Or were they of superior value for fattening hogs? Experimental work is needed to answer all such questions.

A year or two later, a certain field of peanuts was hogged off on the Sand Hill farm of the Wiregrass Sub-

station. Hogs grazed over the whole field with an approximately even intensity except on a delta-shaped area that was an outwash of a very large gully in the upper part of the field. Peanuts on this area were not consumed until the hogs had pretty well cleaned up the crop on the rest of the field. There were little or no apparent differences in the growth of tops or soundness of nuts on this area as compared with the crop on the rest of the field. But there must have been a difference of some kind, and the hogs detected it so definitely that they avoided grazing the area as long as possible. Here again there were differences in the palatability of peanuts that cannot be explained. Did storm water remove from the soil some desirable element when it cut a gully and deposited its soil load at a lower level in the field? If so, what element or elements? Or was it the loss of organic matter? And again, were the peanuts on the two areas of equal feeding value but one just tasted better to the hogs? If these kinds of questions can be answered by experimental work, it might enable farmers to grow peanuts of higher feed value than those now produced, especially on the more sandy lands.

The Gulf Coast Substation at Fairhope is located on soils that are very deficient in phosphorus and the common base elements such as calcium. Forage plants grown on soils of the area usually have a relatively low mineral content, even where average amounts of fertilizer are applied. Consequently, plants that succeed on mineral-deficient soils, such as carpet grass and wiregrass, are very commonly found to be the chief vegetation under natural conditions. Nevertheless, soil treatments may so alter the palatability or nutritive value of such plants that cattle may graze to a line the treated areas in pastures.

At the Gulf Coast Substation two such cases have been observed. In one instance a fairly comprehensive set of variously fertilized plots were planted in a pasture that was being grazed by beef cattle. The fertilized and limed plots were grazed very closely; but none of the unlimed plots, regardless of the other treatments, were so closely grazed. Even the four-foot alleys separating the limed plots were relatively ungrazed.

In the other instance, an 80-acre pasture was treated with an application of 1,300 to 1,500 pounds of basic slag per acre, with the exception of a 100-foot-square area near the middle of the field. The whole area, which was covered with wiregrass when cleared, was disked and seeded to common lespedeza. The resulting vegetation was a mixture of lespedeza and wiregrass. When cattle were turned in on this area, they skipped the untreated plot entirely. This field was used as a pasture for several years and throughout that time the untreated plot was so completely ungrazed that it could be located exactly because of the existence of the tall ungrazed wiregrass. Did the wiregrass on the fertilized area taste better? In all probability, the grass on the fertilized area had a higher mineral content—than that on the unfertilized area. Can cows detect this higher mineral content in some way other than by taste? At any rate, they knew which grass was fertilized and which was not.

Such experiences were not limited to the thin sandy lands of south Alabama, since a similar result was observed with cows on a sericea pasture at the Upper Coastal Plain Substation near Winfield, Alabama. In 1945 a lespedeza sericea pasture was started on old, abandoned broomsedge land. The entire area was prepared alike and fertilized uniformly with an 0-14-10 fertilizer. Part of the area was limed at the rate of 1.1 tons per acre just prior to planting. The pasture was first grazed in 1948, and cows grazed to a line the limed part,

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Fig. 1. Farmers and fertilizer dealers of Faribault County viewing a soil and plant tissue demonstration on the Clarence Meyer farm.

The Diagnostic Approach in Corn Fertilizer Demonstrations in Minnesota

*By Harold E. Jones and Leo E. Orth**

St. Paul, Minnesota

THE medical doctor has long used the diagnostic approach in determining man's physical condition. During the summer of 1952, Minnesota farmers saw a similar technique employed in evaluating the physical condition of corn which had been grown under varying fertility practices. The University of Minnesota Extension Service, Experiment Station personnel, and the Farm Bureau Service Company agronomist set up X-tra yield corn plots demonstrating these practices in about 25 counties.

The soil test, run by the Minnesota Soil Testing Laboratory, and a detailed cropping history of each field were essential in establishing the productive capacity of the soil and as guides in making fertilizer application rate recommendations for maximum corn production.

Plant tissue tests were used to evalu-

* Soils Extension Specialist, University of Minnesota, and Agronomist, Minnesota Farm Bureau Service Company, respectively.

Fig. 2. Mr. and Mrs. Byron Howard, both proud to have participated in a demonstrational program where they produced over 100 bushels of corn per acre. Treatments and yields (left to right) 500# 8-16-16 disked, 150# 4-24-12 row, 300# 33-0-0 sidedressed—yield 140 bushels; 150# 4-24-12 row, 200# 33-0-0 sidedressed—yield 108 bushels; 150# 4-24-12 row—yield 52½ bushels; check—yield 48 bushels.

ate the nutrient levels in the growing corn and to demonstrate soil-plant relationships.

Procedure

Soil specialists met with farmer cooperators who were selected by the county agents and fertilizer dealers to develop the program. A detailed history of the fields was obtained at this time and soil samples were collected for testing. With this information, a plan was outlined for each of the fields. The higher rates of fertilizer recommended for X-tra yield applications

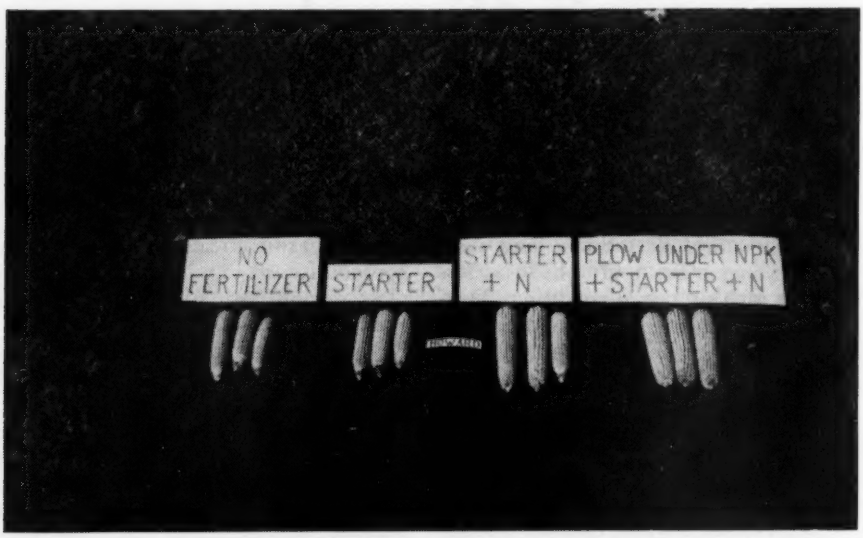

Fig. 3. Representative ears from Byron Howard plots demonstrating deficiencies and differences from fertilization.

were based on average rainfall during the growing season and on the moisture-holding capacity of the soil. The plan included a statement of the purpose of the demonstration, the procedure to be followed, stand of corn, maturity range of hybrid, and time and method of fertilizer application. The importance of good soil tilth and organic matter in regulating the moisture supply was stressed.

Fertilizer was applied at three different times: before planting, as a starter, and after the corn was about six inches in height. A soil-building treatment consisting of several hundred pounds of a complete fertilizer was used on low fertility fields. It was generally broadcast and worked in, but in some cases plowed under. Smaller amounts of a complete fertilizer were used as a starter in the row. Nitrogen was sidedressed at about the second cultivation. Various combinations of these three treatments were used to bring out the role of each in producing maximum yields. For purposes of the demonstration, four rows were left unfertilized for check and the conventional treatment for the local community, generally only a starter fertilizer, was used.

The plan outlined below illustrates a typical demonstrational set-up.

X-tra yield corn fertilization demonstration

Cooperator:
Mr. Byron Howard, Mapleton, Minnesota.

Purpose:
The purpose of this trial is to demonstrate some of the factors involved in the production of maximum corn yields.

Procedure:
Plant corn of not over 110-day relative maturity in 40-inch rows with one kernel dropped each 8 or 9 inches. Fertilize as shown under treatments. The nitrogen sidedressing should be applied between the rows by the time the corn is knee-high or not later than June 20. Only sweeps should be used on cultivator at second and later cultivations. Cultivation should not be deeper than 3 inches at these times to avoid root pruning.

Plot size:
Each plot should be 8 rows wide (check plot excepted, which is 4) and sufficiently long to represent varying soil and productivity differences of the field.

Crop and fertilization history:
Soybeans 1950, corn 1951. No fertilizer or manure applied.

Soil tests: pH 6.0 Phosphate Low Potash High

Treatments:

Number	*Grade*	*Rate lbs/acre*	*Method of application*
1.	none	---	---
2.	4–24–12	150	Starter in row
3.	4–24–12	150	Starter in row
	Ammonium nitrate	200	Sidedressed 2nd cultivation
4.	8–16–16	500	Broadcast & disked in
	4–24–12	150	Starter in row
	Ammonium nitrate	300	Sidedressed 2nd cultivation

Observations:
Record any differences in emergence, tasseling, and silking dates between fertilized and unfertilized. If some unusual differences occur, notify your county agent or fertilizer dealer.

Harvesting procedure:
A 1/100-acre portion of the two interior rows of each plot will be harvested for yield determinations. Soil specialists or extension workers will assist.
A sample of at least 10 ears will be saved from each plot for protein determinations. Moisture determinations will be made, and yields calculated to 15.5 per cent moisture.

Tours During the Growing Season

During the growing season, county agents and fertilizer dealers conducted farmer tours to visit the demonstrations. The specialists were present to help interpret any observations made at the fields. Two or three demonstrations were visited during each tour since none of the fields responded to fertilizer exactly alike. On the tours the plan for each of the demonstrations was presented and the factors governing corn production were discussed in detail. Plant tissue tests and a discussion of the physiology and internal structure of corn plants were quite effective in stimulating interest in the factors influencing corn growth. This was particularly true where visual differences between fertilizer treatments were not readily apparent.

Methylene blue was used to demonstrate the internal structure and conducting tissues of the plant. Methylene blue solution was prepared by placing 3 or 4 pills (obtained from any drugstore) in about a gallon of water which had been slightly acidified with several drops of hydrochloric acid. The hydrochloric acid precipitates any calcium or other bases which might plug the conducting tissues and prevent entrance of the dye into the corn plant. Representative stalks from the various treatments were cut off at an angle just above the soil surface and placed immediately in the methylene blue solution. A sharp knife is important since mashing the tissues will prevent dye from entering the plant. Likewise, placing the cut ends in the solution immediately prevents air from entering the tissues and forming a block. The plants were set in the sun, and preferably in a breeze, for about 4 to 6 hours before the meeting in order to allow the dye to rise in the plants. On cool, cloudy days the transpiration rate is slow; consequently best results were obtained by preparing the demonstration the afternoon before the meeting and allowing the stalks to stand overnight in the solution. In some cases

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Fig. 4. Bill and Al Noy of Vernon Center, Minnesota, demonstrating high production on soil of good tilth, but higher where some fertilizer is used.

Fig. 1. This two-year-old sericea provided both hay and grazing during the dry summer of 1952. It was fertilized with 600 pounds of 0-12-12 per acre applied early spring 1952. H. M. Sloate farm, Spartanburg County, S. C. Soil Conservation Service photo.

Sericea Is a Good Drought Crop

By T. C. Mauer

Regional Agronomist, Soil Conservation Service, Spartanburg, South Carolina

REPORTS from every state in the Southeastern Region of the Soil Conservation Service have given added proof of the value of sericea. The summer of 1951 was dry and the summer of 1952 was drier. Coming one right after the other, they emphasized still further the value of sericea for hay and grazing.

Cooperators with soil conservation districts have seeded sericea on 971,188 acres. They have complete farm plans that call for the planting of an additional 650,000 acres. A large part of this acreage is planted on land of capability classes III, IV, and VII. Much of this land has been abandoned as cropland because of poor yields. When seeded to sericea, not only has soil erosion been stopped but the land has become a decided asset to the man who has cattle to feed.

The dry summers of 1951 and 1952 convinced most cattle owners in the Southeast that they need an adequate acreage of sericea on their farms. A great many of them are in the same frame of mind as Joe Hampton of Portersburg, Ky. He says, "It grew waist high on hill land where nothing else would grow, and also did well on poorly-drained land. My cattle ate it well even though it was too big for top-quality hay. I aim to sow five more acres in sericea next spring."

There are a lot more farmers who are "aiming" to seed an additional acreage to sericea in the spring of 1953.

This new acreage is badly needed by a great many cattle farmers. But it is not good business if we do not manage the present acreage so that it will be back in vigorous condition next season.

Sericea's resistance to drought is due to its deep root system. Such a deep root system cannot be maintained by close mowing or grazing year after year. Research workers have shown that other perennials with deep roots have to be permitted to make a full top growth every few years in order to maintain deep roots.

To get the sericea back in vigorous condition, plans should be made now to make a good application of fertilizer just before growth starts in the spring. This will increase the quality of the hay or grazing and the quantity of seed per acre. Five hundred to 1,000 pounds of an 0-12-12 or similar analysis fertilizer is a good application. After the sericea makes a full top growth, it stores food in the roots and develops its root system. Then it is ready to make early vigorous growth the following spring.

Like any other crop, sericea does better on the more productive classes of land. Very little of the 971,188 acres planted by soil conservation district cooperators has been planted on Class I land. Most of the 650,000 additional acres that have been planned on cooperators' farms will be seeded on the more eroded or less productive land.

Management Practices

As the differences in the productive capacity of the different land capability classes become more widely understood, the management practices for each class will be much more definite. The grazing management is probably the most difficult. Sericea and other grazing crops cannot cry out that they are in great agony when their roots are sloughing off. Neither can they complain about the new growth being taken off just when they are beginning to get their roots down where the water is plentiful. There is a need for everybody who is interested in grass and legumes to think about that part of the plant that is underground, out of sight. A great many professional agricultural workers and farmers are going to be surprised at the depth to which roots will go when the top growth is managed to promote root development.

Sericea has done well on sandy soils. W. B. Forney, Work Unit Conservationist of the Soil Conservation Service in Bibb County, Ga., reports that Harold Haywood, Route 1, Macon, Ga., has 37 acres of sericea that is six years old. Sixty-five dairy cows grazed this sericea half a day every day during July and August. Application of fertilizer has been at the rate of 400 pounds of 0-12-12 each year for the past three years and will be continued at this rate in the future. This field was cut for hay in May 1952. Mr. Haywood has always gotten good grazing from his sericea and is going to plant an additional 40 acres in the spring of 1953. The present acreage of sericea is on Class VII, Rustin sandy loam.

Another use of sericea is in combination with Bahia grass. This is rather a new development that is proving very satisfactory. It has been found that sericea can be grown successfully on the sandier soils where the Bahia has been established first. In such areas, the Bahia is seeded alone and allowed to make one summer's growth. The following spring, the Bahia is disked and the sericea seeded. It is entirely possible that we will find that this combination can be successfully seeded at the same time. However, when the field is so sandy that it is almost certain that sericea alone would fail, it will be advisable to get the Bahia established first.

J. Edison Brinson, Work Unit Conservationist of the Soil Conservation Service in Macon County, Ga., reports on Clyde and James Smith's experience with Bahia and sericea. The Class II fields showed very little erosion. The combination seeding was made in

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Legume and Manure Rotations in the Western Corn Belt

By T. A. Kiesselbach

Agronomy Department, Nebraska College of Agriculture, Lincoln, Nebraska

THE rotation of crops serves a multitude of purposes, and if properly planned, provides the basis for the soundest and most profitable agriculture in the Western Corn Belt. It is an aid in the control of weeds, harmful insects, and certain plant diseases. Through crop diversification a better distribution of farm labor is provided and the chances of complete crop loss resulting from some unfavorable condition are greatly reduced. If forage legumes are successfully grown in the rotation, the soil will be made more productive and better in physical condition through an increase in available nitrogen and organic matter content.

The legumes may be handled in two basic ways, to serve either as feed for livestock, or to be plowed under as green manure. They differ, as all farmers know, in their suitability for such uses and in various localities. Alfalfa, sweetclover, and red clover are the chief rotation legumes of the Western Corn Belt. Vetch is of growing importance on the sandy soils of northeastern Nebraska, and lespedeza occupies some acreage on restricted acid soils elsewhere. The worth of grasses sown as mixtures with the forage legumes, for use as meadow and pasture and for soil erosion control, has come to be fully appreciated in rather recent years.

The extent to which these special soil-improvement crops are grown may be illustrated by the specific crop acreages in Nebraska in 1951. Such production has been estimated officially as alfalfa 1,483,000 acres, second-year sweetclover 200,000 acres, first-year sweetclover 1,000,000 acres, red clover 174,000 acres, and miscellaneous tame hay crops 136,000 acres. These total 2,993,000 acres, which is 18 per cent of the land in cultivation in this State.

Description of Test Plots and Conditions

The University of Nebraska Agricultural Experiment Station has compared nine different crop rotations to determine the effect of the three main legumes (Fig. 1) and of barnyard manure on the yield of the principal cereal crops that follow them. The rotations were from three to nine years in length, and the legumes were grown from one to two years in each cycle of the rotations. They were all started 20 years ago in a single field of the Experiment Station Farm at Lincoln (Fig. 2), the soil being described as Sharpsburg silty clay loam. The tests have been conducted systematically throughout the 20-year period. Only the data from 1943-1951 are summarized and here considered for the reason that at least one cycle of a rotation should be completed before ascribing the yield differences to the rotation effects. Each crop and treatment within a rotation were represented every year in triplicate plots, so that in the nine-year alfalfa rotation, for example, 27 test plots were required annually. The plots were 1/20-acre in size, in addition to having a 3½-foot discard strip planted to the same kind of crop on either side to reduce border competition between the plots.

Except for certain results obtained from liming in the last two years, all of the crops were grown on unlimed soil. From this standpoint they should be rather representative of what may be expected on millions of acres of eastern Nebraska land, most of which has gone to date without lime, even though it has become too acid to grow legumes satisfactorily without liming. This Experiment Station soil now has a pH of 5.5 and definitely needs an application of at least two tons of lime per acre. Although not yet fully determined, it is believed that one such application will serve for a period of at least eight years. This liming should preferably be done at least a year before sowing the legume. Need for the lime should be established for each specific farm by official soil tests, because liming may be harmful where not needed.

The phenomenal increases in growth and yield of sweetclover as a result of liming this strongly acid soil, and of the crops which follow the limed sweetclover, are well demonstrated in supplementary tests herein reported.

Standard tillage, planting, and harvest practices were used throughout these experiments. Red clover and sweetclover were sown with oats in early spring, whereas alfalfa was fall-sown on plowed wheat stubble. The clovers were harvested for hay in the second year except where sweetclover was plowed under as green manure for corn in the second spring.

Results

The crop sequence and 10-year average yields of the nine rotations are reported in Table I. The crops and the manure applications are designated by letters as described in a table footnote. The average annual market values of the crops grown in each rotation are presented in Table II, based on market prices at Lincoln, March 20, 1952. In Table III is shown the far greater response of corn to sweetclover green manure when this strongly acid soil is limed before seeding the legume. These self-explanatory tables are referred to for detailed comparisons.

Nonmanured Rotations.

Grain yields were materially increased in six-year rotations by red clover and sweetclover harvested for hay in their second year. Compared with the yields in the six-year straight grain rotation, the annual yield increases in bushels per acre from the five successive grain crops following red clover were: corn 16, barley 8.4, winter wheat 4.1, corn 13.8, and oats 0.0 bushels. Likewise following second-year sweetclover (Fig. 3), corresponding increases were: corn 14.2, barley 7.0, winter wheat 4.4, corn 12.4, and oats 0.8 bushels.

Following two years of alfalfa harvested for hay in a nine-year alfalfa rotation, the annual increases in yield per acre from the seven successive grain crops were: corn 9.2, corn 12.1, oats 16.9, wheat 4.5, corn 12.3, barley 5.7, and wheat 2.2 bushels. Largely because of its greater forage value and more favorable effect on the oat yield, alfalfa grown for two years in a nine-year rotation proved to be the most effective rotation legume under the conditions of these tests. It exerted some beneficial effect on yield for seven years, whereas that of red clover and sweet clover was limited to four years.

Manured Rotations.

Plowing under 12 tons of barnyard manure before wheat once in a six-year straight grain rotation gave the following yield increases for the six successive grain crops: wheat 8.6, corn 17.7, oats 13.4, corn 8.7, corn 6.4, and barley 5.8 bushels. It is now considered that smaller applications of manure at shorter intervals would be more suitable.

A combination of growing second-year sweetclover and applying 12 tons of manure in a six-year rotation increased the successive grain yields following the manure: wheat 12.1, corn

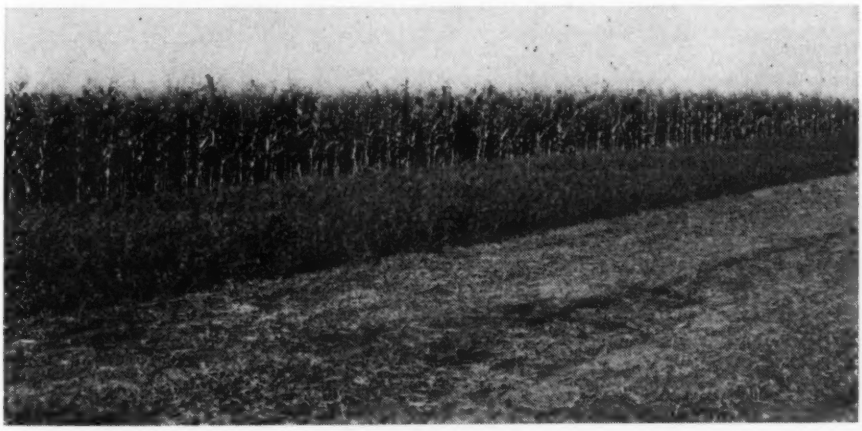


Fig. 1. Three good soil-improving legumes for crop rotation in the Western Corn Belt as grown in the rotation plots on the Agricultural Experiment Station Farm, Lincoln, Nebraska, September 10, 1951. Upper: left—red clover; right—sweetclover started with spring oats on limed soil. Lower: Foreground—second-year alfalfa (3rd cutting): background—corn after second-year alfalfa, yielding 102 bu. per acre, 32 bu. more than in a straight-grain rotation.

22.5, oats 12.6, corn 21.1, and barley 10.8 bushels per acre. It is considered that this rotation represents about the maximum soil fertility that is suitable for crops under these conditions of limited rainfall.

On a monetary basis, in the six-year straight grain rotation, the total gain from 12 tons manure over the entire six-year period of one rotation cycle was $91.68. This amounts to an average annual gain of $15.28 per acre, and the value of a ton of manure in terms of increased crop returns proved to be $7.64. Likewise in the six-year sweetclover rotation, 12 tons of manure increased the crop income per acre by $61.67 for the entire six-year period of one rotation cycle, or $10.28 per year. This amounts to $5.14 per ton of manure. The average value of a ton of manure in both rotations, as measured by the increased crop returns, was $6.39.

Although the grain crops benefited greatly from forage legumes grown in the rotation, the clovers in themselves have not been as profitable at market prices as the corn, wheat, and oats crops. Barley has no place in southeastern Nebraska rotations. Maintenance of well-managed livestock provides a profitable outlet for both forage and feed

TABLE I.—YIELD OF GRAIN AND HAY PER ACRE IN VARIOUS NON-LEGUME AND LEGUME CROP ROTATIONS. AGRONOMY FARM, LINCOLN, NEBRASKA, 10-YEAR AVERAGE, 1942-1951.

No.	Rotation: Successive annual crops and treatment [1]	Yield per acre (14% moisture): Corn: Previous crop	Corn: Each sequent	Corn: Av.	Wheat[2]	Oats	Barley	Forage[3]
			Bu.	Bu.	Bu.	Bu.	Bu.	Tons
	Unmanured rotations							
1	W–C–C–O	W	49.2					
		C	43.2	46.2	30.8	36.9	.....	.....
2	W–C–O–C–C–B	W	52.7					
		C	45.7					
		O	49.3	49.2	32.9	36.2	14.3	.....
3	W–C–Orc–Rc–C–B	W	63.0					
		Rc	65.2	64.1	37.0	36.2	22.7	2.16
4	W–C–Osc–Sc–C–B	W	61.6					
		Sc	63.4	62.5	37.3	37.0	21.3	1.66
5	W–C–Osc–C–C–B	W	53.7					
		C	50.6					
		Osc	50.3	51.5	33.9	34.7	16.5	.....
6	Osc–C–C	Osc	48.7					
		C	47.4	48.1	.....	40.3	.....	.....
7	W–A–A–C–C–O–W–C–B	A	58.4					
		C	61.3		37.4			1.62
		W	61.5	60.4	35.1	53.1	20.0	3.34
	Manured rotations							
8	Wm–C–O–C–C–B	Wm	66.9					
		O	57.9					
		C	55.6	60.1	41.5	49.6	20.1	.....
9	Wm–C–Osc–Sc–C–B	Wm	71.7					
		Sc	70.3	71.0	45.0	48.8	25.1	1.74
	Least Significant Difference (Bu.)	.....	3.4	.....	1.7	2.4	1.6	.....

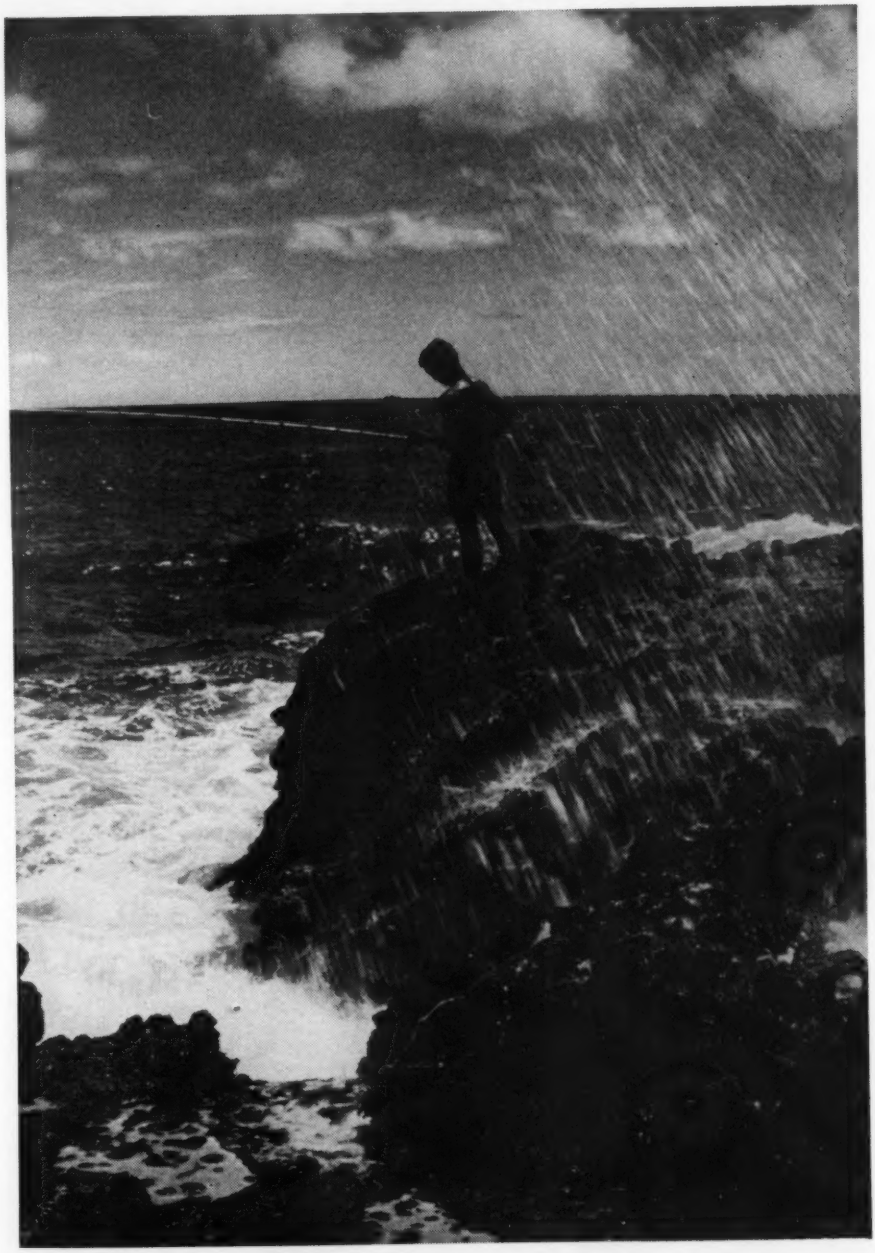
[1] W = winter wheat, C = corn, O = oats, B = barley, Rc = red clover, Sc = sweetclover, A = alfalfa, M = 12 tons manure per acre.

[2] In the alfalfa rotation (No. 9) the two wheat yields follow oats and barley, respectively. The two wheat yields average 36.3 bushels.

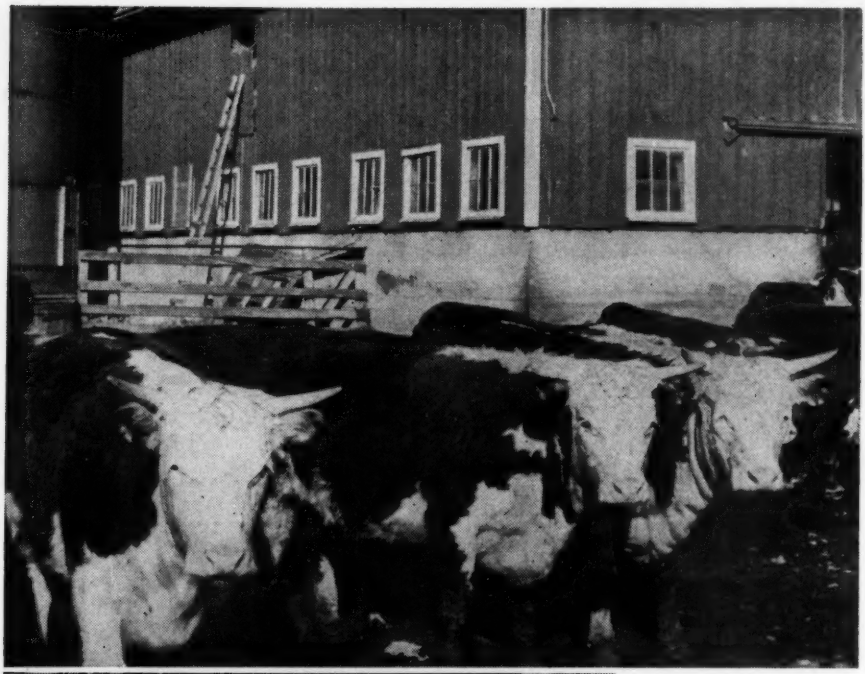
[3] In rotation No. 9, the two alfalfa yields are for first- and second-year crops, respectively. The average alfalfa yield for the two years is 2.48 tons.

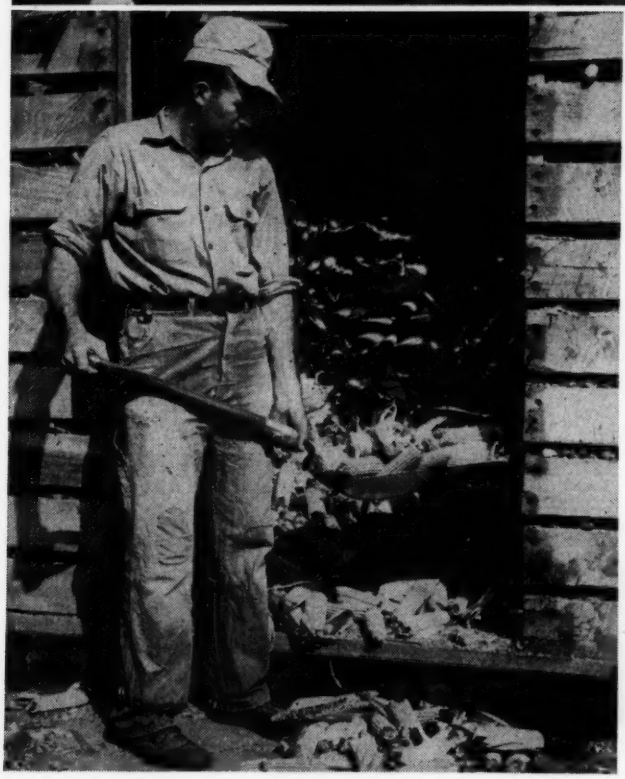
(*Turn to page* 39)

PICTORIAL



Oh, to Be in Hawaii—Fishing!





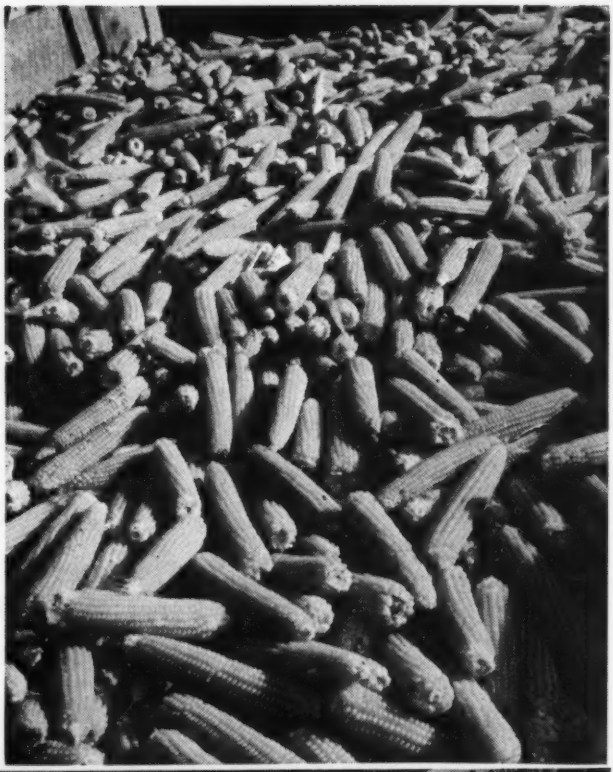
Patience has its rewards.

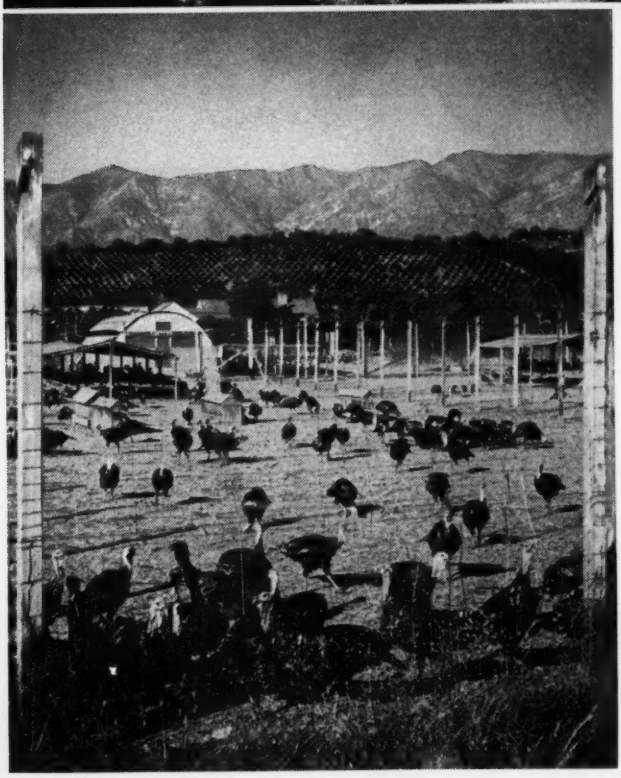
Popcorn—

for

Winter

evenings.





California sunshine casts long shadows.

The Editors Talk

Our Cover Picture

Much has been written about the winter-killing of crops and much research is still being carried on to prevent the great annual loss to good hay and pasture swards and fall plantings of grains. In some sections of this country winter-killing is as much of a hazard as drought to the well-laid plans, hard work, and cash expenditures of practical farmers. More and more evidence points to the fact that not only must cutting and grazing be discontinued and seedings made early enough in the fall for plants to gain strength, but that they must be fed to get this strength.

Our cover illustrates the dependence of root growth, as well as top growth of wheat, upon nutrients available. Of course, the roots starve first as far as minerals are concerned, but roots also depend upon the leaves for supplying carbohydrates for new growth. These typical wheat plants showing potash deficiency were taken on April 22, 1952, from one foot of row from each of two experimental plots, without potash (LNP) and with potash (LNPK), at the Brownstown Soil Experiment Field, Brownstown, Illinois, operated by the Department of Agronomy, University of Illinois. The relative yields were 14.2 and 30.1 bushels during a season when winter damage seemed comparatively severe. The samples, along with others from different treatments, were excavated by metal frames, 12 inches long, 8 inches wide, and 9 inches deep. The frames were forced into the soil and the blocks of soil with the roots intact were lifted from the plots. Then the soil was washed from the roots while supported on a ¼-inch mesh screen.

Note the difference in number, length, and condition of roots. Those with complete treatment were light-colored and showing vigorous early spring growth. The potash-starved wheat had some yellowish-tipped leaves and the roots were less vigorous. Some roots were somewhat brownish and abnormal. Roots from other plots without phosphate or without limestone were very stunted in growth and even darker in color. Similar conditions and results have been noted at other soil experiment fields in this area of gray silt loam soils over tight clay subsoils.

These abnormal root conditions may be called "winter injury" for lack of a better explanation. But what causes this winter injury from deficiencies of either limestone, phosphate, or potash? More root studies, carried out along with other phases of soil fertility research, may help to evaluate the relative importance of those chemical and physical factors of root environments which are termed soil fertility.

Adequate fertility is like a form of crop insurance and "pays off" especially during those years when winter-killing is most severe on young wheat plants. Balanced nutrition helps wheat plants to survive and to recover quickly in the spring. It is said that one realizes the need for insurance most after a house starts to burn, when it is too late to get the insurance. Just as sufficient insurance should be carried on all buildings, adequate fertility should be planned and provided ahead of planting a crop.

More Production Less Work

Commenting on the often-heard wish of farmers with labor problems for a return to "the good old days when they received a day's work for a day's pay," the Federal Reserve Bank of Richmond, Virginia, has some interesting figures to present. Despite the widely held belief that farmers no longer work as hard as formerly and the fact that farm employment has declined significantly since 1935-39, the Bank says farm production has actually increased sharply. On a 1935-39 base, farm output stood at an index level of 139 in 1951. The output per man rose 62%.

Developments contributing to this increase in productivity include increase in mechanization—the number of farm tractors increased from 1,545,000 in 1940 to 4,100,000 in 1951; farm trucks from 1,047,000 to 2,300,000; milking machines from 175,000 to 725,000; combines from 190,000 to 800,000; and mechanical corn pickers from 110,000 to 500,000.

Another important factor in the increased agricultural production and in the rise in labor productivity has been the sharply increased use of fertilizer. Since 1935-39 the amount of plant food contained in commercial fertilizers consumed on American farms has increased 240%, with nitrogen use up 270%, phosphate 192%, and potash 304%.

Other contributing factors have been the use of more productive hybrids and varieties of seed, more spraying and dusting, and new developments in livestock breeding and animal nutrition.

The Bank contends that all of these changes are evidence that modern farming is more of a business proposition than formerly. Modern farms are increasingly becoming production plants to convert machines, fuel, fertilizer, pesticides, and other production items into the food, fiber, and feed which they sell. In other words, capital—in the form of the products the modern farmer buys and uses in his farming operation—has been substituted for farm labor, and the labor still used has been made more productive. This is reflected on many farms by the farmer changing his cropping pattern so as to place more emphasis upon lines of production that require comparatively little labor and less on lines that require great amounts of hand labor.

Dean Funchess

After this issue of this magazine was prepared for press, we were saddened by the news of the sudden death of M. J. Funchess, Dean Emeritus of the School of Agriculture and Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn, Alabama. It had been our pleasure to present to our readers in this issue his article "Palatability of Plants as Influenced by Soil Treatment and Variety Differences."

Dean Funchess died of a heart attack on February 19 at the age of 68. He retired at the end of 1950 after nearly a half century of service for the State of Alabama, first as a teacher and research worker and later in the broad capacity of Dean of the School of Agriculture and Director of the Agricultural Experiment Station. Living up to his motto "Theories are great but facts are better," he was widely known for his facts findings. Under his direction the Alabama Experiment Station received outstanding recognition for its contributions to the betterment of Southern agriculture.

As evidenced by the article written just prior to his passing, Dean Funchess maintained an active interest in research. His death will be recorded with a deep sense of loss by all who knew him and drew upon his many years of experience for guidance.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	...
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.2	163.0	306.0	168.0	211.0	19.50	69.30	....
1952									
February....	37.25	33.8	205.0	357.0	166.0	218.0	20.65	67.10	....
March.....	36.72	23.5	216.0	383.0	165.0	220.0	20.35	61.50	....
April.....	37.30	15.0	231.0	416.0	168.0	218.0	20.05	60.80	....
May.....	36.08	43.5	264.0	433.0	170.0	213.0	18.65	60.80	....
June.....	38.02	44.0	310.0	436.0	173.0	206.0	17.05	61.90	....
July.....	37.02	42.0	274.0	446.0	173.0	198.0	17.25	71.00	....
August.....	37.92	48.8	278.0	410.0	173.0	204.0	19.35	69.80	....
September...	39.11	51.0	222.0	335.0	171.0	209.0	20.25	69.60	....
October.....	36.77	50.9	211.0	294.0	153.0	207.0	20.85	70.70	....
November...	34.05	47.6	217.0	311.0	145.0	213.0	21.25	69.70	....
December....	31.71	49.6	199.0	362.0	150.0	212.0	21.65	68.50	....
1953									
January.....	29.79	46.2	206.0	386.0	148.0	210.0	21.65	65.30	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	207
1946.....	263	382	178	248	212	209	141	319	182
1947.....	257	380	232	248	336	259	148	381	226
1948.....	245	482	222	253	201	226	155	298	214
1949.....	231	459	184	244	193	213	139	192	201
1950.....	323	517	132	197	238	226	141	384	185
1951.....	306	512	233	349	262	239	164	307	239
1952									
February....	300	338	294	407	259	247	174	298	217
March.....	296	235	310	436	257	249	171	273	265
April.....	301	150	331	474	262	247	169	270	308
May.....	291	435	379	493	265	240	157	270	285
June.....	307	440	445	497	269	233	144	275	250
July.....	299	420	393	508	269	224	145	315	287
August.....	306	488	399	467	269	231	163	310	229
September...	315	510	319	382	266	236	171	309	182
October.....	297	509	303	335	238	234	176	314	189
November...	275	476	311	354	226	241	179	309	238
December....	256	496	286	412	234	240	182	304	256
1953									
January.....	240	462	296	440	231	238	182	290	237

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952						
February	3.34	2.07	14.27	11.28	11.61	11.08
March	3.34	2.07	14.26	11.28	9.71	9.04
April	3.34	2.07	14.26	11.28	8.80	8.05
May	3.34	2.07	14.25	11.28	7.75	7.36
June	3.34	2.07	14.27	11.28	8.38	8.38
July	3.34	2.07	14.26	11.28	8.19	7.59
August	3.34	2.07	14.26	11.28	9.78	7.89
September	3.34	2.07	13.39	11.25	11.11	10.02
October	3.34	2.07	13.39	11.24	10.62	9.41
November	3.34	2.07	13.31	11.24	10.32	9.71
December	3.34	2.26	13.20	11.24	9.95	9.17
1953						
January	3.34	2.28	13.25	11.24	8.43	8.05
Index Numbers (1910-14 = 100)						
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952						
February	125	73	408	320	344	315
March	125	73	407	320	288	257
April	125	73	407	320	261	229
May	125	73	407	320	230	209
June	125	73	408	320	249	238
July	125	73	407	320	243	216
August	125	73	407	320	290	224
September	125	73	383	319	330	285
October	125	73	383	318	315	267
November	125	73	380	318	306	276
December	125	79	377	318	295	261
1953						
January	125	80	379	318	250	229

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952							
February	.820	3.98	5.47	.420	.827	16.00	.210
March	.832	3.98	5.47	.420	.827	16.00	.210
April	.840	3.98	5.47	.420	.827	16.00	.210
May	.860	3.98	5.47	.420	.827	16.00	.210
June	.860	3.98	5.47	.353	.708	13.44	.176
July	.860	3.98	5.47	.386	.768	14.72	.193
August	.860	3.98	5.47	.386	.768	14.72	.193
September	.860	3.98	5.47	.389	.768	14.72	.193
October	.860	3.98	5.47	.391	.768	14.72	.193
November	.860	3.98	5.47	.391	.768	14.72	.193
December	.860	3.98	5.47	.427	.827	16.00	.210
1953							
January	.860	3.98	5.47	.430	.827	16.00	.210
	Index Numbers (1910-14 = 100)						
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952							
February	153	110	112	75	87	66	85
March	155	110	112	75	87	66	85
April	157	110	112	75	87	66	85
May	160	110	112	75	87	66	85
June	160	110	112	65	74	56	80
July	160	110	112	70	81	61	82
August	160	110	112	70	81	61	82
September	160	110	112	70	81	61	82
October	160	110	112	70	81	61	82
November	160	110	112	70	81	61	82
December	160	110	112	75	87	66	85
1953							
January	160	110	112	76	87	66	85

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and all Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1927.....	141	148	139	116	89	150	100	94
1928.....	149	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	123	130	127	86	56	130	102	77
1942.....	158	149	144	93	57	161	112	77
1943.....	192	165	151	94	57	160	117	77
1944.....	196	174	152	96	57	174	120	76
1945.....	206	180	154	97	57	175	121	76
1946.....	234	197	177	107	62	240	125	75
1947.....	275	231	222	130	74	362	139	72
1948.....	285	250	241	134	89	314	143	70
1949.....	249	240	226	137	99	319	144	70
1950.....	256	246	236	132	89	314	142	72
1951.....	302	271	263	139	93	331	152	76
1952								
February..	289	276	255	146	98	365	153	78
March....	288	275	251	144	98	336	155	78
April.....	290	276	251	142	98	322	157	78
May.....	293	276	252	142	98	306	160	78
June.....	292	273	250	141	98	316	160	69
July.....	295	273	250	141	98	313	160	73
August....	295	274	252	144	98	337	160	73
September.	288	271	250	145	98	349	160	74
October...	282	269	248	145	98	341	160	74
November.	277	268	248	144	98	336	160	74
December..	269	267	246	146	101	329	160	79
1953								
January...	267	267	246	144	102	307	160	80

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilizers for Cereal, Hay and Pasture Crops," Ont. Dept. of Agr., Parliament Bldgs., Toronto, Can., Cir. 144, July 1952.

"Fertilizers for Delaware, Hay, Grain, Fruit, Pasture, Vegetables," Agr. Ext. Serv., Univ. of Del., Newark, Del., Ext. Fldr. 37, Dec. 1952.

"Effect of Liming and Fertilization on Yield and the Correction of Nutritional Leaf Roll of Irish Potatoes," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 504, Oct. 1952, G. M. Volk and N. Gammon, Jr.

"Know Your Fertilizers," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 506, Nov. 1952, G. M. Volk.

"Fertilizers, Fertilizer Materials and Rock Phosphate Sold in Illinois Jan. 1, 1952 to June 30, 1952," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1545, Oct. 1952, T. Kurtz and N. G. Pieper.

"Fertilizer Recommendations for Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 285, June 1952, H. E. Myers and F. W. Smith.

"1953 Crop and Fertilizer Recommendations for Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 176, Nov. 1952.

"Commercial Fertilizer Results with Oats 1952," Agr. Exp. Sta., Univ. of Neb., Lincoln, Neb., Outstate Testing Cir. 25, Oct. 1952, G. W. Lowrey, R. A. Olson, and A. F. Dreier.

"Report of Analyses of Commercial Fertilizers and Lime Materials Sold in New York State, January 1 to December 31, 1951," Dept. of Agr., Albany, N. Y., Bul. 379.

"Inspection and Analysis of Commercial Fertilizers," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Bul. 401, Nov. 1952, B. D. Cloaninger.

"Fertilizer Recommendations for Virginia," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Bul. 183, Rev. Jan. 1953.

"For Top Pastures Top-Dress," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Cir. 533, Nov. 1952.

Soils

"Soil-Borne Wheat Mosaic," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 556, Aug. 1952, B. Koehler, W. M. Bever, and O. T. Bonnett.

"The Soil That Went to Town," USDA, SCS, Wash., D. C., AIB 95, Nov. 1952, C. W. Gee.

"Agricultural Conservation Program Handbook for 1953 for: Ala., Ark., Calif., Col., Conn., Del., Fla., Ga., Hawaii, Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Neb., N. J., N. Y., N. C., Ohio, Okla., Oreg., Pa., R. I., S. C., Vt., Va., Texas, Wash., W. Va., Wis., Wyo.; USDA Prod. & Mktg. Admin., Wash., D. C.

Crops

"Report of the Minister of Agriculture for Canada for the Year Ended March 31, 1952," Dept. of Agr., Ottawa, Ont., Can., Sept. 1952.

"Annual Report 1951-1952 Issued for Quarter Ended September 30, 1952, State Board of Agriculture," Dept. of Agr., Dover, Del., Bul. No. 3, Vol. 42, C. F. Mundy.

"Cabbage Varieties Adapted to Commercial Production in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 501, Aug. 1952, E. N. McCubbin, F. S. Jamison, R. W. Ruprecht, and E. A. Wolf.

"The Genus Aleurites in Florida: Part I. Botanical Characteristics; Part II. Chemical and Physical Characteristics of the Oils," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 503, Oct. 1952, R. D. Dickey, S. G. Gilbert, and C. M. Gropp.

"Daylilies in Florida," Agr. Ext. Serv., Gainesville, Fla., Cir. 106, Aug. 1952, J. V. Watkins.

"Floriland Oats," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-53, Nov. 1952, W. H. Chapman.

"Eggplant Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 109, Sept. 1952.

"Seedling Improvement in Sweet Potato," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii, Tech. Bul. 17, Aug. 1952, C. F. Poole.

"State of Idaho Seventeenth Biennial Report, July 1, 1950 to June 30, 1952." Dept. of Agr., Boise, Idaho.

"Your Vegetable Garden," Ext. Div. Univ. of Idaho, Moscow, Idaho, Ext. Cir. 124, Sept. 1952, G. W. Woodbury.

"African Violets in the Home," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 695, June 1952, D. Hickman and J. R. Culbert.

"Soybean Varieties for Illinois," Agr. Exp. Sta., Urbana, Ill., Cir. 700, Oct. 1952, J. W. Pendleton, R. D. Osler, C. H. Farnham, and J. L. Carter.

"Golden Harvest Hybrid Sweet Corn," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Bul. 578, July 1952, G. M. Smith.

"Grazing Trials With Beef Cattle at Miller-Purdue Memorial Farm," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Bul. 581, July 1952.

"Results of Research in 1951 by the Agricultural Experiment Station of the University of Kentucky," Agr. Exp. Sta., Lexington, Ky., 64th Annual Report, June 1952.

"Louisiana Yams for Table and Trade," Agr. Ext. Serv., La. State Univ., Baton Rouge, La., Ag. Ext. Pub. 1121, Aug. 1952, J. A. Cox and W. J. Martin.

"1951 Extension Work in Maryland," Ext. Serv., Univ. of Md., College Park, Md., 37th Annual Report.

"Variety, Description and Performance Tests With Maryland Tobacco Measured by Composition, Yield and Value," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. A73, J. D. Bowling, J. E. McMurtrey, Jr., and D. E. Brown.

"Alfalfa Varieties for Maryland," Agr. Ext. Serv., Univ. of Md., College Park, Md., Fact Sheet 52, T. S. Ronningen, A. G. Hess, and S. P. Stabler.

"Growing Corn in Maryland," Univ. of Md., Agronomy Dept., College Park, Md., Mimeo. 49, Apr. 23, 1952, R. B. Rothgeb, F. L. Bentz, Jr. and S. P. Stabler.

"Nebraska Corn Performance Tests, 1952," Univ. of Neb., Dept. of Agronomy, Lincoln, Neb., Outstate Testing Cir. 26, Dec. 1952, A. F. Dreier, J. H. Lonnquist, D. P. McGill, and P. L. Ehlers.

"Report of the Nevada State Department of Agriculture for the Fiscal Years Ending June 30, 1951-1952," State Dept. of Agr., Carson City, Neb., 1952.

"More $ for Your Cotton," Agr. Ext. Serv., USDA, N. M. State College, State College, N. M., Cir. 233, Sept. 1951, M. O. Thompson.

"Research Pays," Agr. Exp. Sta., Wooster, Ohio, Public Relations Series 16, Dec. 1952.

"Allgold, A New High-vitamin, High-yielding Sweet Potato," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Bul. B-388, Nov. 1952, H. B. Cordner.

"Birdsfoot Trefoil," Agr. Ext. Serv., Penna. State College, State College, Penna., Cir. 411, Nov. 1952, J. H. Eakin, Jr.

"Plant Spacing of Sweet Corn," Agr. Exp. Sta., Univ. of R. I., Kingston, R. I., Bul. 316, July 1952, D. D. Dolan and E. P. Christopher.

"Toward the Future with Your College of Agriculture," Univ. of Vt., Burlington, Vt., Combined Report No. 5, Dec. 1952.

"Flax in Wisconsin," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 426, July 1952, J. H. Torrie and G. M. Briggs.

"Growing Field Peas for Hay-Grain-Silage," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 427, July 1952, D. J. Hagedorn.

"Report of the Chief of the Office of Experiment Stations Agricultural Research Administration, 1952," USDA, Wash., D. C.

"Pepper Production, Disease and Insect Control," USDA, Wash., D. C., Farmers' Bul. 2051, Nov. 1952, V. R. Boswell and S. P. Doolittle.

"Commercial Production of Tomatoes," USDA, Wash., D. C., Farmers' Bul. 2045, Sept. 1952, W. S. Porte.

"Production of Turnips and Rutabagas," USDA, Wash., D. C., Leaf. 142, Sept. 1952, W. R. Beattie.

"The Home Fruit Garden in the Northeastern and North Central States," USDA, Wash., D. C., Leaf. 227, Sept. 1952.

Economics

"1951 Agricultural Statistics for Arkansas," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Report Series 35, Aug. 1952.

"Federal Agricultural Assistance Programs Canada, 1900-1951," Economics Div., Mktg. Serv., Dept. of Agr., Ottawa, Can., Apr. 1952, M. R. Cameron and F. Shefrin.

"Why Some Farms Earn So Much More Than Others," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 558, Aug. 1952, M. L. Mosher and V. I. West.

"Roadside Marketing in Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Bul. 577, Aug. 1952, R. L. Kohls, F. C. Gaylord, and C. M. Orth.

"Pasture Improvement Costs in Southern Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Bul. 579, July 1952, W. D. Stalder, L. S. Robertson, and G. L. Richardson.

"Farmer's 1952 Income Tax," Ext. Serv., Univ. of Md., College Park, Md., Ext. Bul. 144, Nov. 1952, R. E. Moser, P. L. Putnam, V. B. Hart, and E. P. Callahan.

"An Economic Study of Production of Canning Tomatoes in Utah, 1948 and 1949," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 355, Aug. 1952, E. M. Morrison and G. T. Blanch.

"Horticulture in the State of Washington, Data for 1948-1949-1950-1951," USDA, Bur. of Agr. Economics, Wash., D. C.

"Facts About Horticulture in the State of Washington 1946-1947-1948," USDA, Bur. of Agr. Economics, Wash., D. C.

"High-Grade Alfalfa Hay Methods of Producing, Baling, and Loading for Market," USDA, Wash., D. C., Farmers' Bul. 1539, June 1952, W. H. Hosterman.

"Maintaining Drainage Systems," USDA, Wash., D. C., Farmers' Bul. 2047, Oct. 1952, J. G. Sutton.

"The Demand and Price Structure for Corn

and Total Feed Concentrates," USDA, Bur. of Agr. Economics, Tech. Bul. 1061, Oct. 1952, R. J. Foote, J. W. Klein, and M. Clough.

"The Work of the U. S. Forest Service," USDA, Wash., D. C., Agr. Inf. Bul. 91, Aug. 1952.

"The Agricultural Economy of Indonesia," USDA, Wash., D. C., Agr. Monograph 15, July 1952, J. E. Metcalf.

"Fruits (Noncitrus) Production, Farm Disposition, Value, and Utilization of Sales, 1944-49, Revised Estimates," USDA, Bur. of Agr. Economics, Wash., D. C., Stat. Bul. 114, Oct. 1952.

"1952 Acreages and Production with Goal Comparisons," USDA, Bur. of Agr. Economics and Prod. & Mktg. Admin., Wash., D. C., Dec. 23, 1952.

"Crop Production, 1952 Annual Summary, Acreage, Yield, and Production of Principal Crops by States, With Comparisons," USDA, Bur. of Agr. Economics, Wash., D. C., Dec. 1952.

"Crop Production, Farm Production, Farm Disposition, and Value of Principal Field Crops, Revised Estimates 1944-49, by States," USDA, Bur. of Agr. Economics, Wash., D. C., Stat. Bul. 115, Oct. 1952.

Legume and Manure Rotations . . .

(*From page* 26)

grains and is a source of valuable manure.

Green Manure Crops and Lime

Sweetclover was grown throughout the 20-year period as a one-year green manure crop in both three- and six-year rotations. Started with oats as a companion crop harvested for grain, it was plowed for corn in the following spring. Neither the corn nor other crops that followed gave a significant response. This can be explained by the results of a supplementary test as follows:

A year prior to sowing sweetclover in the three-year rotation consisting of oats with sweetclover, corn, and corn, two tons of lime per acre were applied to one-half of each plot to determine the effect on sweetclover growth and the indirect effect on the following corn yield in 1950 and 1951. Averaging both years (Table III), the unlimed portion yielded 56.2 bushels corn per acre as against 87.9 bushels

Fig. 2. Airplane view of crop-rotation plots on Agronomy Farm in the foreground and of the farmlands to the northeast. June 21, 1950.

for the limed portion. The gain was 31.7 bushels per acre, or 56 per cent, in response to the more productive growth and beneficial soil effects of the sweetclover. It is clearly evident that this land is in urgent need of liming in order to obtain favorable sweetclover growth which in turn adds materially to the soil productivity for following crops.

Lime increased the first-year sweetclover yield an estimated 400 per cent.

TABLE II.—MARKET VALUE OF CROPS PRODUCED PER ACRE IN VARIOUS NON-LEGUME AND LEGUME ROTATIONS. AGRONOMY FARM, LINCOLN, NEBRASKA, 10-YEAR AVERAGE, 1942-1951.

Rotation		Income per acre [2]							
		Corn							
No.	Successive annual crop and treatments [1]	Previous crop	Each sequent	Av.	Wheat	Oats	Barley	Forage	Av. all crops
	Unmanured rotations								
1	W–C–C–O.....	W	$78.72						
		C	69.12	$73.92	$70.84	$33.21	.....	.....	$62.97
2	W–C–O–C–C–B.....	W	84.32						
		C	73.12						
		O	78.88	78.77	75.67	32.58	$18.59	.....	60.53
3	W–C–Orc–Rc–C–B.....	W	100.80						
		Rc	104.32	102.56	85.10	32.58	29.51	$38.88	65.20
4	W–C–Osc–Sc–C–B.....	W	98.56						
		Sc	101.44	100.00	85.79	33.30	27.69	24.90	61.95
5	W–C–Osc–C–C–B.....	W	85.92						
		C	80.96						
		Osc	80.48	82.45	77.97	31.23	21.45	.....	63.00
6	Osc–C–C.....	Osc	77.92						
		C	75.84	76.88	.....	36.27	.....	.....	63.34
7	W–A–A–C–C–O–W–C–B..	A	93.44						
		C	98.08	.....	86.02	.....	.....	32.40	.....
		W	98.40	96.64	80.73	47.79	26.00	66.80	69.96
	Manured rotations								
8	Wm–C–O–C–C–B.....	Wm	107.04						
		O	92.64						
		C	88.96	96.21	95.45	44.64	26.13	.....	75.81
9	Wm–C–Osc–Sc–C–B.....	Wm	114.72						
		Sc	112.48	113.60	103.50	43.92	32.63	26.10	72.23

[1] W = winter wheat, C = corn, O = oats, B = barley, Rc = red clover, Sc = sweetclover, A = alfalfa, M = 12 tons manure per acre.

[2] Income per acre calculated from yields given in Table I at following market prices as of March 20, 1952: corn $1.60, wheat, $2.30, oats $0.90, barley $1.30, alfalfa $20.00, red clover $18.00, and sweetclover $15.00.

Fig. 3. Effect of second-year sweetclover in the rotation upon the yield of winter wheat in the rotation plots on the Agricultural Experiment Station Farm, Lincoln, Nebraska, 1951. The crop is being inspected by W. E. Lyness who has been associated with these experiments since their beginning. Left: Wheat three years after second-year sweetclover in a six-year rotation. Yield was 24.6 bu. per acre. Right: Wheat after oats in a non-legume rotation. Yield was 11.4 bu. per acre.

First-year sweetclover used in a short rotation as a green-manure crop for corn is evidently very successful and profitable when strong soil acidity has been rectified. Without the lime, the first-year sweetclover is practically without effect on this soil. By the second year without lime, the sweetclover becomes so much better established that it contributes far more to the yield of the succeeding corn crop. Even this, however, is strikingly less than for the first-year sweetclover when limed. It has been concluded by the Soil Testing Service of this Experiment Station that millions of acres of eastern Nebraska soil are now so acid as to need an application of lime for the forage legumes

TABLE III.—COMPARATIVE EFFECTS OF LIMED AND UNLIMED FIRST-YEAR SWEETCLOVER UPON THE PERFORMANCE OF THE FOLLOWING CORN CROP. AGRONOMY FARM, LINCOLN, NEBRASKA, 2-YEAR AVERAGE, 1950 AND 1951.

Previous crop	Lime per acre	Performance of the corn crop						
		Yield per acre (14% moisture)		Protein in grain (moist-free)	Ears			Plant ht.
		Grain	Stover		Per 100 plants	Av. wt.	Shelling per cent	
	Tons	*Bu.*	*Tons*	*Pct.*	*No.*	*Lbs.*		*In.*
Oats [1]	0	57.0	1.703	8.1	98	41	84	95
Oats and sweetclover [2]	0	56.2	1.587	8.0	95	43	84	94
Oats and sweetclover [2]	2	87.9	1.985	10.2	111	57	85	97

[1] Data from rotation No. 2 (wheat, corn, oats, corn, corn, barley).
[2] Data from rotation No. 6 (oats with sweetclover, corn, corn).

at the rate of two or more tons per acre.

When it is said that soil productivity is increased by growing forage legumes, it should be remembered that they increase only the available soil nitrogen content and improve soil structure. As in the case of other crops, the phosphorus, potassium, and calcium in the soil will actually be lessened by the legumes if harvested and removed from the land. Their rate of soil depletion will be lessened if feed grains and forage are fed to livestock and the manure is spread in the fields, and crop residues as straw, stubble, and cornstalks are left on the land. On most farms, complete dependence should not be placed in the legumes and grasses for maintaining soil productivity. They help with soil structure and the legumes help with nitrogen, but the time has come when proper supplementary use needs to be made of suitable commercial fertilizers in the Western Corn Belt as has been true in more Eastern States for many years.

Sericea Is a Good Drought Crop . . .

(*From page* 22)

March 1951, fertilized with 500 pounds of 0-14-10, and 1 ton of lime was applied. In March 1952, 200 pounds of nitrate of soda were applied. Twenty-six dry dairy cows were grazed alternately on two 9-acre fields from April 1 until the last of June. They had no other feed during this period. In July 1952, the two fields were cut for hay and yielded 350 bales. James Smith's comment was, "It was our salvation this summer." An additional 25 acres were planted to this sericea-Bahia combination this past spring and 18 acres will be planted in the spring of 1953. The summer-grazing program of these brothers is based on the sericea-Bahia mixture.

If all the acreage of sericea that is contemplated at this time is seeded next spring, it will take a lot of seed. There are several things that can be done in preparation for seeding sericea:

1. Start seedbed preparation two to three months ahead of the best seeding date. Natural settling, or a corrugated roller, can provide a smooth firm seedbed.

2. Seed on time. Usually about three weeks ahead of early corn planting season. Sericea can also be seeded successfully after small grain is harvested. Disk the grain stubble just enough to loosen a seedbed, leaving the grain stubble as surface mulch.

3. The rates of seeding are 30 to 40 pounds of recleaned and scarified seed per acre or 50 to 60 pounds of unhulled seed per acre. This rate can be reduced by at least 10 pounds per acre if the seedbed is well prepared.

4. Fertilization with 600 to 800 pounds of 0-14-10, 0-12-12, or similar analysis is recommended on land that is fairly free of summer weeds. On land that has had a heavy stand of crabgrass, it will be better to wait until the early spring to fertilize. If there is any doubt about getting the fertilizer on the next spring, it will be best to fertilize at the time of seeding and keep the summer weeds clipped.

5. The method of seeding should be one which will give the most even distribution of the seed. A grain drill with a fine-seed box, a cultipacker seeder, or a cyclone seeder can be adjusted so as to do a good job.

There are several things it might be well to keep in mind about sericea. It can't stand much competition the first year. For this reason, there have not been very many successful seedings

made on small grain. Except on very clean land with high fertilization, it does not make a very impressive amount of top growth the first summer. Don't become discouraged and decide to plow it up because you think the weeds have crowded it out. Get someone who has had some experience with first-year sericea to examine the stand.

Don't overwork your field of sericea. Over-seedings have usually retarded spring growth, slowed down the growth, and reduced the total yields of the sericea. A pure stand of sericea is needed as insurance against early spring drought and to bridge the gap between the winter and summer grasses.

Sericea has made a reputation for itself the past two droughty summers.

Wheat Gives Greatest Fertilizer Response

WHEAT responds more to fertilizer than any other common field crops, according to an extension agronomist at Ohio State University. Earl Jones says clover and alfalfa seeded with wheat give the next greatest response. "Increases in the hay crop alone often pay for fertilizer used on wheat," he adds.

In Ohio, 400 to 500 pounds of fertilizer per acre on wheat give best results if a meadow seeding is made with the wheat. If farmers do not plan to make a meadow seeding, they may reduce this by about one third.

On productive soils, Jones recommends 0-20-10 or 0-12-12. Less productive soils on a late seeding after corn or soybeans need a mixture such as 4-12-8, 3-12-12, or 4-16-8. The agronomist explains that only phosphoric acid and potash are recommended where lodging is likely.

Go Easy With Trace Element Fertilizers

UNWISE use of minor or trace element fertilizers in Illinois may likely do more harm than good, cautions a University of Illinois agronomist. According to T. C. Tucker, most Illinois farmers have little reason to get excited over trace element deficiencies, with the exception of boron in some areas. Boron, zinc, copper, manganese, and molybdenum are now recognized as being essential to normal plant growth in small amounts.

While there is some indication of deficiency of one or more of the other minor elements, investigations are in an early stage and results to date have not been conclusive, Tucker says. Emphasizing the need for caution in the use of minor elements, he warns that there is danger of toxic effects if too heavy applications are used. Farmers suspecting deficiencies other than boron are advised to try minor element fertilizers on a small area of a field and observe the results.

Whether or not a soil needs boron can be determined in a soil test in the University of Illinois soil testing labora-

tory. If the soil needs boron, it's important to follow recommended rates of application. Crops most likely to need more boron in Illinois are the legumes, particularly alfalfa.

More interest has been shown in the element cobalt recently because of its importance in animal nutrition. Cobalt, as far as is known, is not needed for plant growth. But the amount of cobalt in the soil influences the amount taken up by feed crops, which in turn is important in livestock feeding.

Tucker reports that while there is no widespread need for testing Illinois soils for zinc deficiencies at this time, a method of testing for zinc has been worked out for research project work. It has not yet been developed for practical general use in soil testing.

Goes "By the Book"; Produces 130-bushel Corn Yield

APPLICATION of just about every lesson on how to grow corn that might be found in a modern textbook brought a southeastern Ohio farmer a 132-bushel corn yield, his county agricultural agent reports.

C. E. Blakeslee, Meigs County Agent of the Agricultural Extension Service, said Andrew Cross, Pomeroy, learned and practiced his lessons so well that he produced 132 bushels an acre while aiming at a 100-bushel goal.

After Cross bought the farm last spring, he obtained a soil inventory which showed the land needed from 1½ to 3½ tons of lime an acre. He spread 3 tons. Checking his soil tests, facts about how fast fertilizer takes effect, and nutrients required to produce 100 bushels, Cross decided to plow down 600 pounds of 10-10-10 and to apply 300 pounds of 10-10-10 at planting time. He also put on 250 pounds of 20½ per cent nitrogen when he cultivated the last time.

Cross figured 16,000 plants per acre were about right for his land and desired yield. He controlled weeds by cultivating and applying 2,4-D and by applying TCA when Johnson grass was a problem. To maintain organic matter for future yields, Cross sowed a cover crop of rye grass and sweet clover.

Although rainfall from May 15 to October 1 was 4 inches below average, Cross produced 132.4 bushels at 16.7 per cent moisture; 111 bushels at 13.9 per cent; 89 bushels at 16.5 per cent and 111 bushels at 16.5 per cent moisture in four different areas.

Palatability of Plants . . .

(*From page* 16)

leaving almost untouched the unlimed area. Again, in the summer of 1949, this decided preference for the limed part of the pasture was shown. Why this preference for the sericea on the limed land? The sericea apparently grew as well on the unlimed as on the limed area. Chemical analyses of clippings from the two areas showed some small differences in both protein and mineral content, but from the limited data available these small differences

are not considered nutritionally significant. Then why the decided preference for sericea from the limed area? This is a question for future research to answer.

At the Tennessee Valley Substation at Belle Mina, on a strong, fertile soil of limestone origin, the same kind of experience was had with crimson clover when used for hog pasture. On a 20-acre field, 15 or 16 acres received 600 pounds of basic slag per acre, while the other 4 or 5 acres received none. The clover came up and grew off uniformly on the entire 20 acres, but when the hogs were turned into this area they grazed to a line the part that had been treated with slag. Samples of clover from the two areas were not analyzed, but there must have been some kind of difference between the herbage on the two areas, and the hogs were able to detect the difference. Was the nutritional value of the clover on these two areas different? Or did the clover on the slagged area just taste a little better to the hogs? If the nutritive value differed on the two areas, was the difference due to increased mineral content, increased protein, or what?

Up to this point this discussion has dealt with the possible effects of fertilizer treatments on the attractiveness to farm animals of certain field-grown feeds. Now let's note a case where one variety of oats was much more closely grazed than another, when grown under identical conditions. At the Gulf Coast Substation, a field of oats was planted for winter grazing for hogs. A part of the field was planted to Red Rustproof oats and the other was planted to Quincy oats, planting date, field treatment, etc., being identical. But hogs grazed Red Rustproof oats to a line and skipped

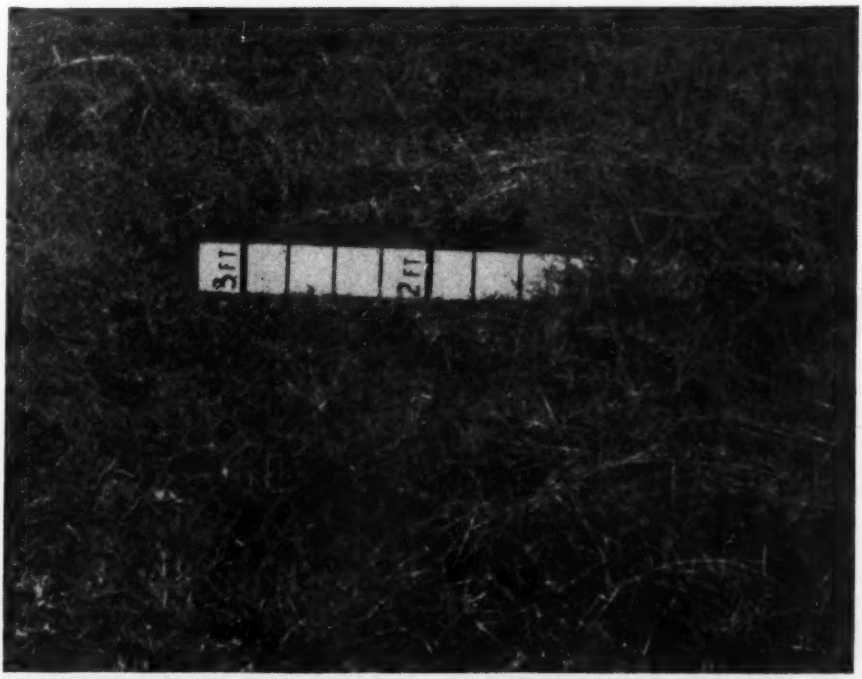


Fig. 1. Cattle prefer well-managed pasture. In the photo above, the measuring stick is laying across the outer edge of a treated pasture plot and extending into the non-treated 4-foot alley (right). The treated plot received mineral fertilizer and lime. Note how closely the treated area has been grazed, while little or none of the alley has been grazed.

the other as late in the season as heading time.

In 1950, Wadsworth Brothers of Prattville, Alabama, hogged off a field of corn in which a part was planted to North Carolina Hybrid 1027 while the other part was planted to North Carolina 1032. Both hybrids were planted the same day, fertilized alike, and in all respects handled alike. By personal letter, Jack Wadsworth reported: "After the hogs had eaten all of 1027, the 14 rows of 1032 were still standing. There was something that the hogs liked in the North Carolina 27 corn." In a study of relative hardness of various varieties and hybrids of corn, Dr. W. G. Eden of the Alabama Agricultural Experiment Station found North Carolina 1032 to be among the hardest of all varieties tested. This may explain why hogs preferred other corn over North Carolina 1032.

All of these observed preferences of farm animals for forage and grain may have practical significance, but as of now it is not known if they do. They are interesting, however, in that they show that farm animals are definitely able to distinguish between forage or seed from areas that had received different treatments as to fertilizer and lime, as well as between different varieties of grain that may differ in hardness or possibly in taste or chemical composition.

These recorded instances of animal preferences for forage or grain may not have any agricultural significance, but it would be very interesting to know if there were actual differences in the food value in these cases where farm animals showed a definite preference for grain or forage from differently treated areas of land. These kinds of results are good examples of the expanding field of research problems that always come from the prosecution of a good research program. They indicate that as we develop and enlarge our research program we will constantly unearth new and additional problems that should be solved but which cannot be attacked because no single state agricultural experiment station can conduct research on all of the known problems confronting the farmers it is trying to serve.

Sixteen Years of Soilbuilding . . .

(*From page* 14)

built. Each of these will play its part in putting back into production those acres that have been set aside or probably never before used in the over-all farming picture.

The interest in farm ponds has increased very rapidly since 1950. In 1950, through the combined assistance of the Agricultural Conservation Program and the Soil Conservation Service, Addison and Rutland Counties built 49 ponds on 46 farms. In 1951 the number jumped to 116 ponds in 10 counties. Therefore, in two years, a total of 165 farm ponds have been built, with all but four counties making use of this water-conserving practice.

While not too popular a practice because of the heavy construction cost, well over 16,000 square yards of riprap work have been constructed on stream banks to prevent further erosion by flood waters. This work saves much of the farmer's best cropland which borders the streams of varying size and which many times wind their way through the farm fields.

Vermont Work Fits National Picture

Vermont's conservation needs tie in with those of our Nation in general and each of the 48 states makes up an economic unit which can either be weak

or strong as the folks of that state would have it.

In the United States as a whole, erosion has severely damaged over 275 million acres of the crop and grazing land available. This acreage equals the combined areas of Illinois, Iowa, Missouri, Kansas, Nebraska, and Wyoming. In addition to this, another 775 million acres of our crop, grazing, and forest land have been eroded to some extent. This leaves us about 460 million acres of good land which is suitable for crops, and that's all we have left. Yet in the face of all we know about land losses, our annual loss to erosion is about one-half million acres.

As our population in the country as a whole increases, the amount of available cropland per person goes down. Twenty-five years ago there were 3¼ acres of cropland per person. Today there are less than 2¼ acres, and our population over and above the death rate is known to be increasing by well over 7,000 persons per day.

It took a major depression in this country to make us realize that farmers will not and economically cannot do all that is necessary to keep their land in a high productive state for future generations. Education alone could not convince farmers of the real job that had to be done and the Agricultural Conservation Program as one of the tools available has been society's contribution through tax monies to help with the work. These monies have made it possible to make a start on the tremendous task of rebuilding and reclaiming those acres which have, and are, and will continue to be a liability unless something is done to save them.

Get Most Conservation for Dollar Spent

In Vermont, farmer PMA committeemen have accepted the responsibility of seeing to it that the million dollars which are presently provided the State annually for ACP work are well used. In addition to the monies that are provided for conservation use, the Vermont farmers, themselves, more than match the amount of Government funds made available. By so doing, the Vermont farmer has a stake in the job, thus taking the program out of the category of just another "hand-out." Whether it is in Vermont or the United States as a whole, we cannot afford to let our land resources continually be mined and wasted without some systematic method of conserving them for the future. We must continue to do something about it and above all see to it that the most conservation for the dollar spent is obtained.

Grasses and Weeds . . .

(*From page* 10)

least able to compete with grasses and legumes when the nitrogen level is high and the available potash is low. On the other hand, nitrogen fertilization often helps the grass-legume balance. Since ladino clover is adapted to higher temperatures than orchard grass, this mixture often reverts to clover in the southern region of the orchard grass belt. In this situation late grazing in the spring and summer nitrogen fertilization encourage the grass growth and help keep a balance of grass and clover.

Soils often need to be supplemented with lime, phosphorus, potash, boron, sulfur, and other minerals to maintain a balance of grasses and legumes. Where nitrogen fertilizers increase the yields, it is especially important to keep level of fertilizer nutrients high. The most recent work at Blacksburg, Virginia, shows that grasses and legumes compete for potassium in the absence of

Fig. 6. Short pastures during the summer months can often be improved by summer nitrogen and potash applications.

nitrogen fertilizers.

Where yields of sods are increased by applying nitrogen fertilizers, the level of other fertilizer minerals must be kept high enough in the soil to support an increase in herbage yield and supply nutrients for all plants in the sod.

The Diagnostic Approach . . .

(*From page* 20)

specimens were prepared in advance and mounted on laths.

Soil and plant tissue tests were the main tests run when field tours were held early in the growing season. On July 2 a tour was held in Faribault County on the Irven Hawkins farm in the forenoon and on the Clarence Meyer farm in the afternoon (Fig. 1). Results from tests on corn tissue showed a high nitrate and potash content compared to a medium to low test for phosphorus. Mr. Meyer was planning to sidedress the field with nitrogen, but on the basis of soil and tissue tests and past history, he was advised against sidedressing except on a demonstrational basis. Where ammonium nitrate was sidedressed at 100 lbs. per acre, the maturity of corn was delayed with no increase in yield. Mr. Meyer stated that without tissue tests he would not have understood why the nitrogen sidedressing was not beneficial.

A greater amount of planning and preliminary work was required for a field tour when the plants were more fully developed. A typical tour stop in August was at the Lawrence Flower farm in Swift County near Benson, Minnesota. The county agent outlined the demonstration plan and pointed out differences between treatments. He stressed the value of having a high fertility level and discussed the hunger signs which indicated a low nutritional level such as firing of the leaves, lack of filling on ear tips, small ears, uneven stands, and delayed maturity. The specialist then selected cornstalks from the various treatments which he split down the center, dissecting the midrib of each leaf. Attention was called to the ear primordia at the base of each

leaf and their formation during the first few weeks of the corn's growth. The importance of a starter fertilizer containing phosphorus in ear set and stalk size was emphasized.

The methylene blue dye test which had been set up earlier in the day was then brought into the demonstration. The movement of water and nutrients, the manufacture of sugars and proteins, and the function of the nodes as "switchyards" * in sieving out precipitated metals like iron and aluminum and in shunting materials to the leaves and ear were discussed. The dye test illustrated especially well the importance of keeping the "pipelines" * open, for free movement of mineral elements and for those compounds manufactured within the plant.

The comparative distance that the dye had moved upward in the plants low and high in potassium was used to show the important role of this nutrient in keeping the "pipelines" open and healthy. Plants with poor root systems, diseases, corn borer damage, and mechanical injury due to cultivation were used to illustrate the detrimental effects of these things on the efficiency of the conducting system and on the health of the plants. A few drops of a 10% solution of potassium thiocyanate followed by a drop or two of a 10% hydrochloric acid on nodes of corn well supplied with, and corn low in, potash illustrated to the farmers the accumulation of iron in the nodes of potash-deficient plants.

Both the Purdue and the Bray plant tissue tests were used at the field meetings. Each has advantages, but regardless of which one was used its value was dependent on the technique and common sense of the tester. The tests were not used to predict yields or to make fertilizer recommendations, but rather to give the farmer an appreciation of the complexity of plant feeding in relation to fertility levels, moisture status, soil tilth, temperatures, stand competition, and other related factors. The importance of each element to plant growth and maturity was stressed.

* Terminology and explanatory material obtained from G. N. Hoffer.

Tours at Harvest Time

Field meetings similar to those during the growing season were conducted at corn harvest time. A typical tour was one held in Blue Earth County in

Fig. 5. Field laboratory equipped to analyze soil and plant tissue.

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south central Minnesota where a group of farmers visited two demonstrations one afternoon. A committee of the farmers assisted in harvesting three 1/100-acre plots from each treatment during the morning before the tour for yield demonstrations. The corn from each treatment was displayed in wire containers, labeled as to treatment and yield.

The first tour stop was at the Byron Howard farm near Mapleton, Minnesota. The purpose of the demonstration and how it had been conducted were explained to the group, and a brief history of the field and its past management was given. The soil is of lake-bed origin and classified as Blue Earth silty clay loam. Mr. Howard had taken over this land about two years ago. The field had a past history of mostly corn, oats, and soybeans with little manure or fertilizer. The general fertility level of the soil was low and its tilth poor. Yield results (Fig. 2) illustrated to the farmers that corn yields could be increased markedly on low fertility land by broadcast applications of high amounts of fertilizer directly on the corn ground as a soil-building treatment. Representative ears from each plot were used to illustrate that plant-food deficiencies, not weather, were responsible for poor ear development on the inadequately fertilized corn (Fig. 3). The increasing importance of moisture supply, proper stand, and good tillage methods was stressed as factors in making effective use of heavier fertilizer applications.

The second stop on the tour was 10 miles from the Howard farm on the Alfred Noy farm near Vernon Center. The soil on these plots was a dark, heavy prairie soil called Webster silty clay loam and management during the past few years has been excellent. Legumes were grown in a good rotation and plowing under green manure crops was a common practice. Fairly heavy applications of manure had been made and fertilizers were used on corn and legumes in the rotation. Yield

results (Fig. 4) were used to illustrate that when a high soil fertility level has been maintained, additions of heavy rates of fertilizer directly to the corn are not necessary or practical. The importance of having sufficient stand to take advantage of the high fertility level was emphasized. Attention was directed to the effects of soil organic matter on increasing soil moisture reserves and thus stabilizing production on a high level over a period of years.

At the end of the tour mounted specimens of well-nourished corn plants and of plants deficient in nitrogen, phosphorus, and potassium, prepared during the growing season by using the methylene blue dye test, were used to summarize the importance of adequate nutrition to corn development and high yields.

Summary

The effectiveness of the diagnostic approach used in the Minnesota corn fertility demonstrations during 1952 was very well expressed by Russell Gute, County Agent of Steele County, after 250 farmers had just completed a harvest-time tour of 4 of the 16 demonstrations he supervised this year. Gute commented, "These farmers have obtained in this one season a better understanding of corn production and how to make corn a partner in a complete conservation system of farming than we have been able to give them during the 11 years I've been working in this county."

Information's Harvest . . .

(*From page* 5)

one leader, one achievement. America seldom depends on single individuals alone to carry the spark of newer knowledge. Credit for doing this belongs to a multitude, even reaching down into the counties and townships. In fact, information studies have shown that the word of a respected neighbor who has been converted to some new practice has more weight and motivation than almost any other "tell-how" medium.

Out of the years of "find-how" and taking it afield to usefulness there have grown up hundreds of notable men and women devoted to a lifework of extension information and demonstration. I have found during a career of farm reporting that the best ones were cordial, tireless, patient, friendly, hopeful folks of good will. I have known many of them to travel far, be away from home days on end, tote heavy and bulky materials to and fro. What will happen through television to lessen their mileage without marring their performance and effectiveness is anyone's guess. This is indeed the anniversary of extension information pioneers together with the overture to a whole new system of "tell-how" no less revolutionary.

Before quoting from some of the speeches and papers of Dr. Knapp as suitable for this anniversary, let's take a quick look-see at the extension-demonstration-information deal as it is.

The Cooperative Extension Service influenced about six and a half million families in 1951. Of these, four-fifths of the families that changed their agricultural practices and three-fifths of those who changed home and household methods were farm families. There were besides over two million boys and girls enrolled in 4-H clubs who received leadership in agricultural, homemaking, and social, spiritual, and civic work. Here the devoted aid of volunteer club leaders and parents enhanced the service of professional extension specialists.

Besides the more than a million local leaders enrolled in this extension cru-

sade, the regular extension staffs are credited for 1951 with nearly a million "news stories" and 165,000 radio talks. They distributed 23 million publications issued by the state colleges and the Department of Agriculture; held over two and a half million meetings with a record attendance of an estimated 75,520,000 persons. The county agents now at work in all main agricultural counties were recorded as having handled personal farm contacts through 8,565,000 phone calls, as many office calls, and 3,668,000 farm and home visits. Men and women agents were said to have made personal contacts with 20 million persons in 1951—and that's what gets results.

And as we scan this statement it must be remembered that in this super-technical age of agriculture there is a greater immediate and constant need for correct and up-to-date information than ever before. In every realm of farming, from economics to zoology and electronics, the pressure per unit for higher and higher output calls for new ways and means based on fast changing scientific findings. The "know-how" of today may become the back number discard of tomorrow.

CONSIDER, therefore, some of the pointed and eloquent statements by Dr. Knapp during his busy years:

"There is only one effective way to reach and influence the farming classes and that is by object lessons . . . There must be at least five or six demonstration farms and quite a few cooperators in each township to make it practical to reach every neighborhood, arouse interest and competition everywhere in the community. To do this requires at least one agent in each county."

Can you recall those first county agricultural agents who had to work by the trial-and-error system in your state? I know one such who graduated from the agricultural college in his late forties, willing to begin thus rather late in life to conform to the new theory of education. That he succeeded against age obstacles is proven when we tell you that he ended his public service career as boss of farmers' institutes.

RETURNING to more Knapp quotations:

"Our greatest need being a wide knowledge of common things, the teacher who really enters into country life and seizes its opportunities for developing the resources of the country, for increasing the harvests, improving the landscapes, brightening the homes, and flooding the people with knowledge of helpful things, will never want for friends nor for places to teach. How joyfully will such a teacher be welcomed! The sound of her footsteps on the approaching walk will be sweeter music to the cottage inmates than ever came from organ or piano even under the touch of genius."

"Home conditions will ultimately mold a man's life. You may do all that you are a mind to in schools, but unless you reach in and get hold of that home and change its conditions you are nullifying the uplift of the school. The home eventually controls the viewpoint of man."

"Colleges of agricultural and mechanic arts: Your work will not be done until every farmer and planter shall be so well instructed that he will mold the soil to his profit and the seasons to his plans, till he shall be free from the vassalage of mortgage and the bondage of debt and become a toiler for pleasure, for home, for knowledge, and for country; until capital and labor shall unite under the leadership of knowledge and equitably divide the increment of gain. Your mission is to solve the problems of poverty, to increase the measures of happiness, and to the universal love of country add the universal knowledge of comfort, and to harness the forces of all learning to the useful and the needful in human society."

"Instructions to county demonstra-

tion agents: Sometimes farmers have peculiar views about agriculture. They farm by the moon. Never try to disillusion them. Let them believe in farming by the moon or the stars, if they will faithfully try our methods. It does not pay to waste good breath on such matters. Avoid discussing politics or churches. Never put on airs. Be a plain man, with an abundance of good, practical sense. Put your arguments in a sensible, practical way. Secure the country village influence and induce the citizen to give active aid. When the tide of local opinion has set in favor of better methods of farming it will be found easy to maintain interest."

DR. KNAPP believed in diversified farming but he once asked how the man who has nothing can diversify. He cannot buy the fraction of a cow or a pig, it was pointed out. In respect to advancing credit and improving the existing structure of rural credit in his time, he declared as follows:

"The credit system has been a potent factor in depressing agriculture. It might have been a necessary evil in a limited way forty years ago, but it prospered and became dominant, oppressive, and insolent. It unblushingly swept the earnings of toil from the masses into the coffers of the few. It substituted voluntary for involuntary servitude, and poverty by contract under the fear of the sheriff for the ownership by birthright and a government by proprietary right. So we have lived under a slavery where the chains were ingeniously forged and the bands riveted with gold."

And we close these random quotes with one that has a spiritual turn:

"The power which transformed the humble fishermen of Galilee into mighty apostles of truth is ever present and can be used as effectively today in any good cause as when the Son of God turned his footsteps from Judea's capital and spoke to the wayside children of poverty."

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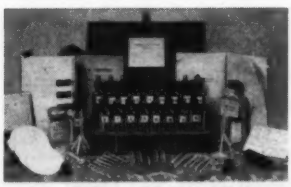

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THE AMERICAN POTASH INSTITUTE

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The hillbilly and his wife came to the movie with their nine children of assorted sizes. The hillbilly and his wife had a hard time controlling their children, much to the annoyance of the theater manager.

"You should have left half your children at home," the manager said in exasperation.

The hillbilly looked the manager right in the eye. "We did," he said sadly.

* * *

Drunk in telephone booth: "Number, hell! I want my peanuts!"

* * *

The second lieutenant and the WAC were walking down Lover's Lane . . . the moon was full . . . the air was scented and everything was quiet when suddenly the WAC whispered: "Lieutenant, you're out of step."

* * *

"Is she your best girl?"
"No, just necks best."

* * *

Pat and Mike were having dinner together. Pat helped himself to the larger fish.

Mike: "Fine manners, ye have, Pat. If I reached out first, I'd take the smaller fish."

Pat: "Well, ye've got it, haven't ye?"

* * *

If there's any surplus fat on a person a bicycle will bring it out.

Three professional football players were sitting on the bench exchanging yarns about how they happened to leave school and take up professional playing.

"In my senior year at Yale," said the first player, "they made me take calculus. I just couldn't make head nor tail of it, so they threw me out on my ear."

"That's the way it was at Michigan," said the second man. "In my junior year I had to take advanced trigonometry, and I wasn't able to understand a thing, so out I went."

Then the U.C.L.A. man spoke up. "Say, did you fellows ever run across a subject called long division?"

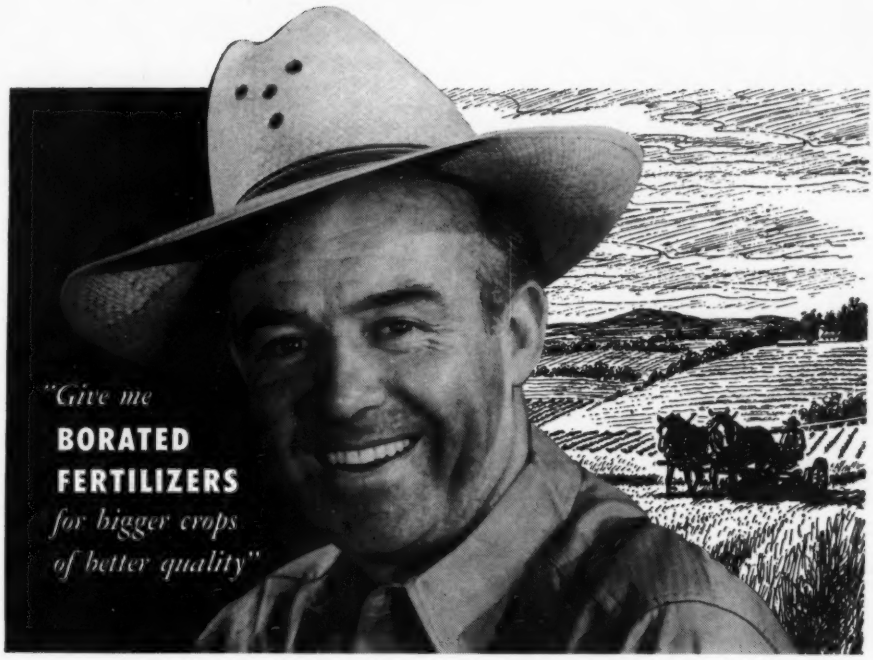
* * *

A GI returned to camp exhausted after a week-end of wine, women, and song. On the bunk that held his recumbent form his buddies hung a sign: "Temporarily Out of Ardor."

* * *

A cub reporter on a certain small-town southern newspaper was sternly reproved by his editor for being verbose in preparing his stories. A little later he was dispatched to write up the death of a well-known local merchant who had suddenly expired.

Looking over the young man's shoulder an hour later, as he prepared his story, the editor read: "Howard Jones, prominent merchant of this city, was walking along the street this morning, when he suddenly clasped his hands to his heart and said, 'I'm going to die'. Then he leaned up against a fence and made good."



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FERTILIZER BORATE (*equivalent to approximately 93% Borax*) and FERTILIZER BORATE-HIGH GRADE (*equivalent to approximately 121% Borax*) come in fine mesh for addition to mixed fertilizer, or coarse mesh for direct application where required. This material saves you important money in cost of transportation, storage and handling, etc., because water content is held to approximately 24% water (5 mols). County Agents or State Experimental Stations should be consulted for detailed recommendations. Write today for literature!

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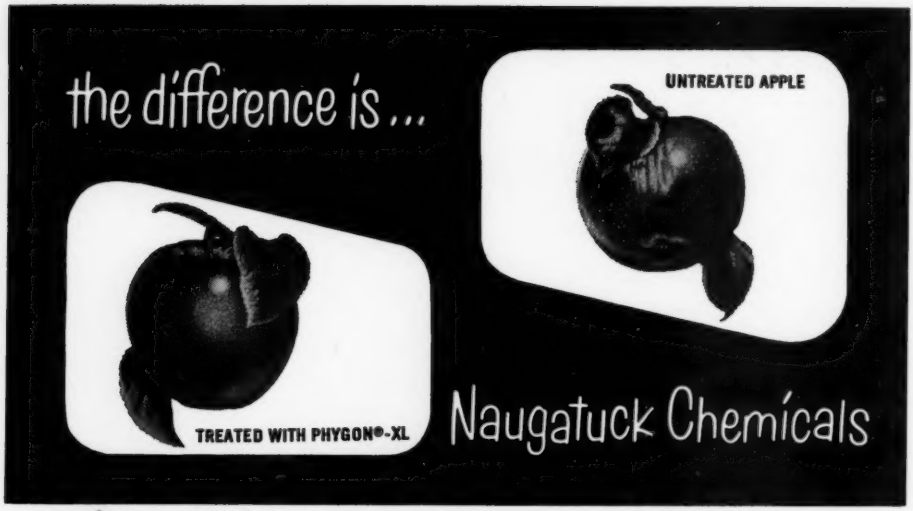

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